

SERVICING

hi-fi

PREAMPS AND AMPLIFIERS

Includes Two Sections . . .

SECTION I—SERVICE FACTS ABOUT PREAMPS AND AMPLIFIERS

- Analyzing Equalization Networks
- Using the Audio Signal Generator to Test Amplifier Response
- A Glimpse into Stereo Preamp Design
- Interesting Facts About Feedback in Amplifiers

SECTION II—COMPLETE PHOTOFAC SERVICE DATA on 33 models of 1957-58 Preamps and Amplifiers

- PHOTOFAC Schematics
- Resistance Charts
- Cabinet and Chassis Photographs
- Parts Lists and Replacement Data

A *Haward W. Sams*

PHOTOFAC PUBLICATION—HF-4



SERVICING HI-FI PREAMPS AND AMPLIFIERS

VOLUME 4

(HF-4)



HOWARD W. SAMS & CO., INC.

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SERVICE FACTS ABOUT PREAMPS AND AMPLIFIERS

ANALYZING EQUALIZATION NETWORKS

In a hi-fi system, it is generally desirable to have a flat frequency response over the entire audible range. This doesn't mean that every component (speaker, amplifiers, cartridge, etc.) will have a flat response, nor does it mean that corrective measures will be taken with every unit to produce this desired response. It does mean, however, that action should be taken to insure that the output will be as nearly like the original music or sound as possible.

What do we mean by flat? Simply stated, a flat response is realized when, after the volume control is adjusted to reproduce the original volume level at any one frequency, this same volume level will be reproduced at all frequencies on the recording. Now that we have established the need for a frequency response that is flat and covers the entire audible range, let's see how equalization and equalizers fit into the picture.

Those of you who are familiar with the specifications for playback power amplifiers know that a typical listing of these specs might be 30 watts of audio over the range of 20 cps to 50 kc ± 1.5 db at less than 3% IM (intermodulation) distortion. You should also be familiar with the fact that a speaker enclosure is designed to load the speaker and, thus, match it to the output amplifier to produce an essentially flat frequency response. It is also readily accepted that voltage amplifier stages can be designed with a flat frequency response over the entire audio range. Why, then, is equalization (frequency compensation) needed?

There are two main reasons — the pickup device used in the playback system, and the recording itself. Let's examine the recording first. Most pickup cartridges utilize the velocity principle, where the output signal voltage is proportional to the excursion rate of the needle. It just so happens that when the record is cut to produce equal velocities for all frequencies of the same voltage amplitude, the excursion distance is inversely proportional to the frequency.

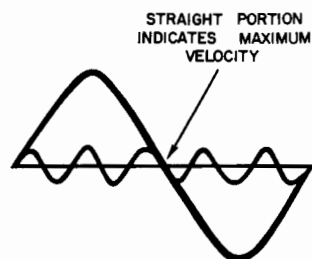


Fig. 1. A constant velocity at all frequencies results in higher amplitudes at low frequencies.

In Fig. 1, two signals are superimposed to illustrate this phenomenon. This would mean (using practical figures) that if an excursion of 1/10,000 of an inch produced maximum output voltage at 20,000 cps, then the excursion required to produce the same output at 20 cps would be 1/10 of an inch. Naturally, grooves 1/10 of an inch wide cannot possibly be packed 100 to the inch on a record. Some LP and extended play 45's even have more than 100 grooves to the inch. For this reason then, the amplitudes of low-frequency sig-

nals are attenuated before they are applied to the record.

On modern recordings, this attenuation is not done on a helter-skelter basis. Instead, most recordings are now based on the RIAA (Recording Industry Association of America) curve shown in Fig. 2.

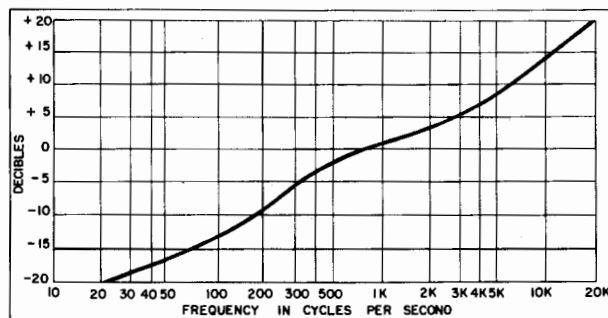


Fig. 2. RIAA recording curve (± 2 db tolerance).

As you can readily see, all signals with a frequency below 1,000 cps will be attenuated, while those above 1,000 cps will be boosted. Applying this information to your knowledge of a playback system, you can see that if we are to hear music as it sounded before being put on the record, some frequency compensation must be employed in the playback system. The RIAA playback curve in Fig. 3 is the reverse of the record curve in Fig. 2, and equalization in the playback must boost the low frequencies and attenuate the high frequencies in accordance with this curve to produce a flat response.

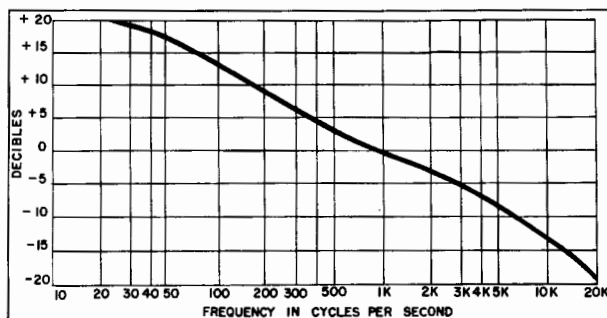


Fig. 3. RIAA playback curve (± 2 db tolerance).

This, of course, assumes a flat response characteristic for the pickup device — a condition not always found. To compensate for the frequency-characteristic differences between the various pickup devices, tone controls that can either boost or attenuate both low and high frequencies are included in playback systems, but the ranges of these controls are generally not sufficient to complement the record curve. Thus, a special circuit that accomplishes the required equalization is incorporated in the playback amplifier and is almost always made up of combinations of resistors and capacitors. Let's examine the basic circuit in Fig. 4 and see how this combination of resistance and capacitance can be used for frequency correction.

First of all, let's eliminate the components not primarily tied in with frequency correction — the plate-load resistor R1 for the first stage, the coupling capacitor and DC blocker C1, and the DC return R4 for the grid of the second stage. Actually, C1 does affect the low-frequency response since its impedance will be fairly high at low audio frequencies, but this is not the reason it is used. As a matter of fact, its effect is the opposite of what we are trying to obtain and must be considered in the design of the compensating network.

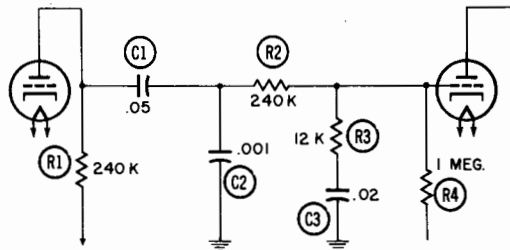


Fig. 4. Basic equalization circuit.

Getting into the network itself, we find that C2 and R2 form a low-pass filter network which attenuates the highs more than the lows. This happens because the higher the frequency, the lower the value of X_C for any given capacitor. In the vernacular of the hi-fi fan, C2 provides high frequency roll-off.

Now we get to the series network of R3 and C3, and again we have a reactance (X_C) that varies with frequency. If you calculate the reactance of a .02-mfd capacitor, you will find that: at 60 cps, X_C equals 191K, at 1,000 cps, X_C equals 7,950 ohms; at 10,000 cps, X_C equals 795 ohms; and at 20,000 cps, X_C equals 397 ohms. Since X_C and R are in series, the net result is an impedance which varies from 12,397 ohms at 20 kc to 203,000 ohms at 60 cps.

If we further analyze this circuit, we see that any signal at the junction of C1, C2 and R2 will divide between R2 and the combination of R3 and C3. Since the total impedance of R3 and C3 is higher at low frequencies, more signal voltage will be applied to the output grid at low frequencies. This is the type of equalization circuitry employed for a common variable-reluctance style of pickup cartridge.

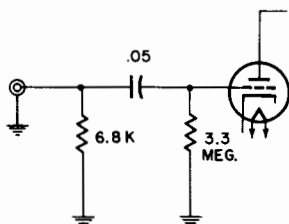


Fig. 5. Equalization in input circuit.

Equalization may not always be accomplished entirely between the halves of a dual triode, as shown in Fig. 4. In many cases, high frequency roll-off is accomplished through the use of a small resistor across the input, as shown in Fig. 5. Its purpose is to provide damping for the variable-reluctance cartridge and, thus, reduce the highs.

Other types of pickup devices usually require different equalization characteristics; furthermore, different circuit designs (such as pentode-to-triode or triode-to-pentode) will require different equalization network configurations. However, these circuits could also be analyzed for an understanding of how they are used to accomplish equalization.

USING THE AUDIO SIGNAL GENERATOR TO TEST AMPLIFIER RESPONSE

Testing a high-quality amplifier without specialized equipment has always been a problem. However, an amplifier can be checked for power output and frequency response with an audio signal generator, AC voltmeter, and scope. If the scope has a wide bandpass response, flat from 0 to 1,000,000 cps or greater, a square-wave audio signal can be used to check both high- and low-frequency responses of the amplifier. If, however, the scope is the general-service type (response to 500 kc), then a sine-wave signal is more suitable. The limited response of a narrow-band scope will distort the square wave slightly and affect the accuracy of the test.

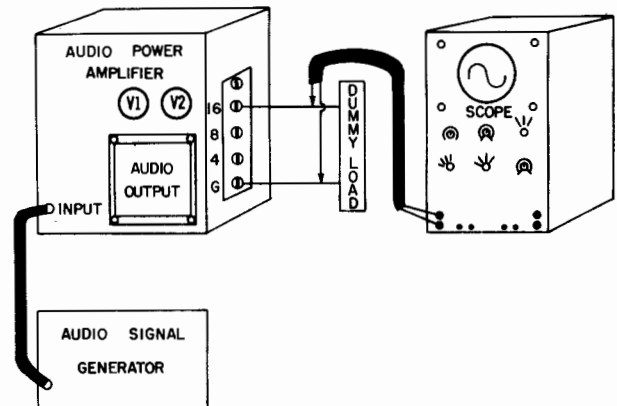
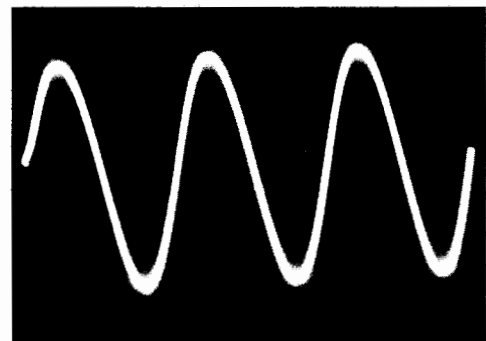
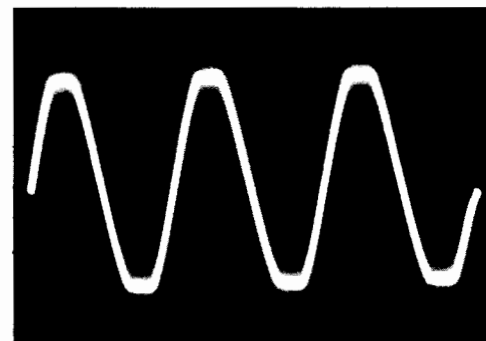


Fig. 6. Test setup for checking amplifier gain over the audio-frequency range.



(A) No clipping.



(B) Mild clipping.

Fig. 7. Comparison of scope patterns observed when setting generator gain level.

In making the test setup, the audio sine-wave signal is applied to the amplifier input, and the speaker output terminals are terminated with a suitable resistor (8 or 16 ohms of a wattage equal to or greater than the power rating of the amplifier). The scope is connected across this resistor, as shown in Fig. 6. A 25-ohm, 100-watt potentiometer makes a good universal dummy load.

After allowing about 15 minutes for warmup, set the signal generator frequency at 1,000 cps and adjust the signal level to the point just below clipping, as illustrated in Fig. 7. The AC output voltage can now be measured across the dummy resistor. A sensitive AC VTVM is best for this measurement; however, a conventional 5,000 ohm-per-volt VOM will give satisfactory performance. Compare your readings with those in Table I to obtain the power output capability of the amplifier under test. If you use a conventional VOM, your amplifier is producing a power output equal to or slightly higher (10 to 15%) than the figure in the table.

DUMMY LOAD— —4 OHMS		DUMMY LOAD— —8 OHMS		DUMMY LOAD— —16 OHMS	
VOLTAGE	WATTS	VOLTAGE	WATTS	VOLTAGE	WATTS
2	1	4	2.0	8	4
2.3	1.3	5	3.125	9	5
2.6	1.71	6	4.5	10	6.25
3	2.25	7	6.125	11	7.5
3.5	3	8	8	12	8
4	4	9	10.1	13	10.6
5	6.25	10	12.5	14	12.25
6	9	11	15	15	14
7	12.5	12	18	16	16
8	16	13	21	17	18
		14	24.5	18	20
		15	28	19	22.5
		16	32	20	25
				21	27.5
				22	30
				23	33
				24	36
				25	39
				30	56
				35	75.6
				40	100

Table I. Power Output in Terms of Voltage Across Fixed Resistor.

To check frequency response, adjust the signal-generator frequency to the lowest frequency the amplifier can pass, and adjust the generator output to produce a signal level above which clipping will take place. Repeat this operation at 500- to 1,000-cps increments across the audio spectrum, noting the voltage reading obtained. Plotting the readings on a graph, as

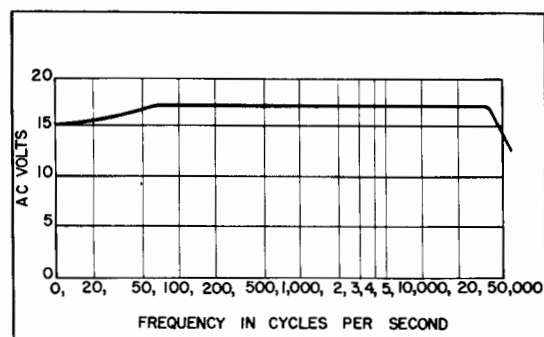


Fig. 8. Amplifier response graph obtained by plotting output voltage readings.

shown in Fig. 8, will provide a gain curve of the amplifier. Harmonic or intermodulation distortion will not be evident; but if the gain curve is fairly flat across the band (similar to Fig. 8), the amplifier is doing a reasonably good job. If you need a more accurate check, use a harmonic distortion analyzer and intermodulation analyzer in the prescribed manner.

A GLIMPSE INTO STEREO PREAMP DESIGN

To say a preamp is a preamp and a stereo preamp is simply two preamps would be like saying any two babies are twins. Since we know a 6SN7 won't work as the final amplifier in a 100-kw transmitter stage, we can realize that a stereo preamp isn't just two of everything. While two of everything is required, several other considerations are of utmost importance to stereo operation. In the block diagram of Fig. 9,

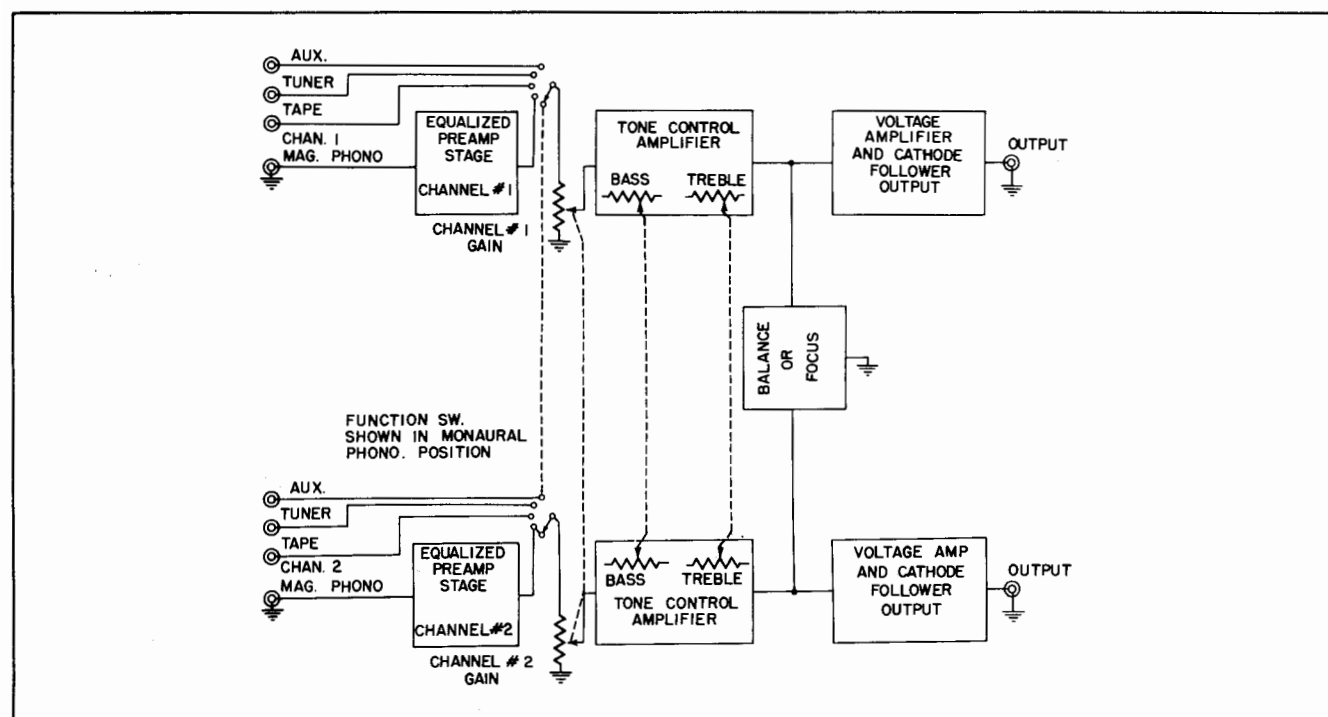


Fig. 9. Block diagram of basic stereo preamplifier, showing pair of identical sound channels, ganged controls, balance network, and function-switch circuit.

for example, you will notice such things as balance control, ganged controls, monaural phono position, and two input jacks for each position on the function selector (except monaural phono). Ganged equalization switches that simultaneously provide the desired equalization to both preamplifier stages may also be provided.

Of particular interest is the fact that the function selector switches, gain, treble, and bass controls of the two channels are ganged — making this portion of the stereo preamplifier no more complicated to operate than a single-channel preamplifier.

The gain controls in Fig. 9 might be labeled volume or loudness in a commercial unit. The function would be the same, however — to vary the output signal of the two channels equally and simultaneously. The ganged bass and treble controls need no explanation other than that they provide simultaneous changes in bass or treble response for the two channels. The design of the circuit in each channel must consider this ganged operation, and the components selected must be of close tolerance to insure a balanced operating condition.

The balance or focus control is peculiar to stereo preamps — monaural units don't have one. This control provides precise balancing of the two output signal amplitudes. If, for any reason (such as unbalanced gain in the preceding stages), the output signals are not identical in amplitude, the balance control can be adjusted to achieve the desired degree of equality. While the balance control is shown connecting the two channels, it does so only from a DC bias standpoint. It does not link the signals in the two channels, nor does it in any way cause the two signals to be mixed.

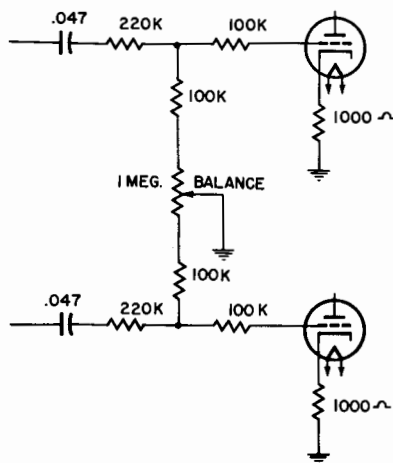


Fig. 10. Schematic of balance control network between stereo preamp channels.

The sample circuit in Fig. 10 shows how the balance control connects into the circuit to do its required job. As you can see, the control is in the common grid return and varies the ratio of DC resistance in each grid circuit. Because of this feature, a stage of gain is provided after the balance control and just ahead of the usual cathode-follower output stage. Thus, where some commercial preamp designs have employed only two dual-triode tubes (one tube as equalized preamp, one-half tube as tone-control amplifier, and one-half tube as a cathode follower), many stereo preamps will employ three dual triodes in each channel. When this is done, one tube will probably be used

for equalized preamp stages, one as a tone-control amplifier, and one as a voltage amplifier and cathode-follower output.

The major problem in stereo preamp design is to construct the unit so that it will provide identical performance on both channels without interaction between the two. This is achieved by the use of close-tolerance components, matched tubes, adequate filtering and decoupling between the two channels and the power supply, and careful layout of components so that ground loops will not be created. While the foregoing are most important on the manufacturing level, they also enter the picture whenever service is required. The service technician should replace defective components with replacements having identical ratings and characteristics. Furthermore, replacements should be installed exactly like the originals; ground connections, etc., should not be moved, even though it may be easier to connect a part differently. Also, any tube to be used in a stereo preamp should be aged in the circuit for 24 hours before the unit undergoes a final check prior to its return.

INTERESTING FACTS ABOUT FEEDBACK IN AMPLIFIERS

Feedback is a term often encountered by anyone active in audio work, especially by those who have a particular interest in amplifiers. Persons who work with public-address systems may connect the term with the howls and squeals that occur when sound from a loudspeaker is picked up by the microphone which picked up the original signal. The service technician, on the other hand, may be reminded of the whistles and squeals heard from a radio loudspeaker because unwanted feedback or coupling in some part of the receiver circuit caused the circuit to oscillate.

Feedback occurs when a portion of a signal in one part of an amplifier is reintroduced, or fed back, to a circuit nearer the amplifier input. The feedback is positive when the signal fed back is in phase with the input signal, in which case the gain of the circuit will increase and cause oscillation. The feedback is negative when the signal fed back is out of phase with the input signal. In this case, the gain of the circuit will be reduced.

We will concern ourselves here with the negative (or inverse) feedback applied to amplifiers to obtain certain desirable results. Almost everyone who works with amplifiers is acquainted with the basic principle of how an out-of-phase signal is fed back into an amplifier to reduce distortion, but this is only part of the story and is far from being enough to be of much assistance when an amplifier is being tested or serviced. The service technician should be familiar with the principles involved in negative feedback because some unusual and puzzling conditions can arise when a circuit included in a feedback loop is modified or disturbed. The term "feedback loop" refers to the circuit between the point where the feedback signal is taken from the circuit and the point where it is fed back into the circuit.

Negative feedback is largely responsible for the very low percentages of distortion featured by modern high-quality amplifiers. Only a few years ago, an amplifier with five per cent harmonic distortion was considered very good, but now the situation has changed. With the use of negative feedback, improved circuits, and high-grade output transformers in

present-day amplifiers, one-half per cent harmonic distortion at rated output is common, and much lower percentages are not at all unusual.

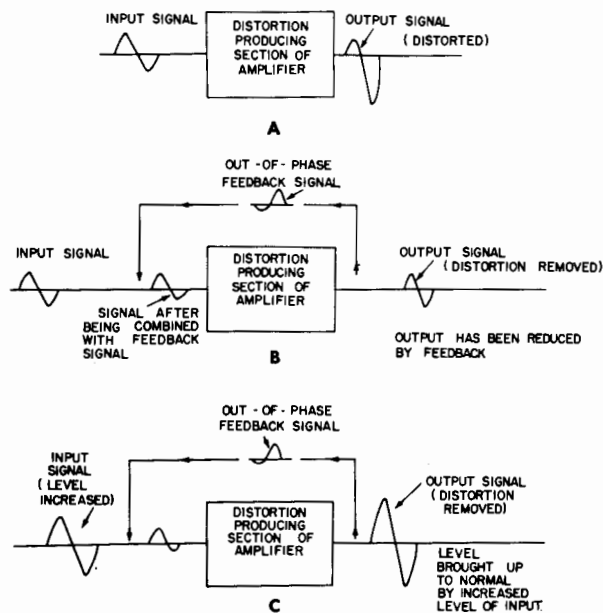


Fig. 11. The effect of negative feedback on a distorted signal.

The basic effect of negative feedback is illustrated in Fig. 11. The undistorted input signal and the distorted output signal are shown in Fig. 11A. The distortion of the output signal is evident because one peak of the signal waveform reaches a greater amplitude than the other. Such distortion, due to the non-linear operation of tubes and other circuit components, is characteristic of amplifiers. A portion of the distorted output signal is fed back out of phase to the input, where it combines with and modifies the input signal, as shown in Fig. 11B. The input signal is actually distorted by the out-of-phase feedback signal, so that the greater part of the distortion developed in the amplifying circuit is counteracted. Note that in Fig. 11B, the amplitude of the output signal has been reduced because of negative feedback. The output can be brought up to its normal level, as in Fig. 11C, if the

level of the input signal is increased. The power-handling capabilities of amplifiers are not reduced by the application of negative feedback.

To be effective, the out-of-phase feedback signal must be taken from the amplifier at a point following the circuit in which the distortion is developed and must be fed into the amplifier at a point ahead of the circuit in which the distortion is developed.

The amount of negative feedback in an amplifier is rated in decibels and is the ratio of the output voltage obtained without feedback to the output voltage developed when feedback is applied. In other words, it is the gain reduction, in decibels, caused by the application of negative feedback.

The amount of negative feedback that can be used is limited, for several reasons. In the first place, we can realize that the full signal could not be fed back because the output would then drop to zero. This is never approached in actual practice because more than 20 decibels of feedback are seldom applied in a single feedback loop.

If 20 decibels of feedback were used in such a manner as to be fully effective, distortion and noise in the circuit would be reduced by a factor of 10. The gain of the circuit would also be reduced by a factor of 10; therefore, 10 times the amount of signal required before the feedback was applied would have to be used to obtain the same power output. For example, if 0.1 volt of input signal were required for a 20-watt output from an amplifier without feedback, then 1.0 volt of input signal would be needed to obtain the normal output of 20 watts after 20 decibels of feedback were applied.

An amplifier must be carefully designed and must use high-quality components if any large amount of negative feedback is to be utilized satisfactorily. Otherwise, the operation of the amplifier can become very unstable, even when only a moderate amount of feedback is applied.

Negative feedback is not a cure-all and must not be relied upon to make an excellent amplifier out of one that was poorly designed with undesirable characteristics. Negative feedback can make a very noticeable improvement in the operation of a mediocre amplifier, but it cannot work miracles.

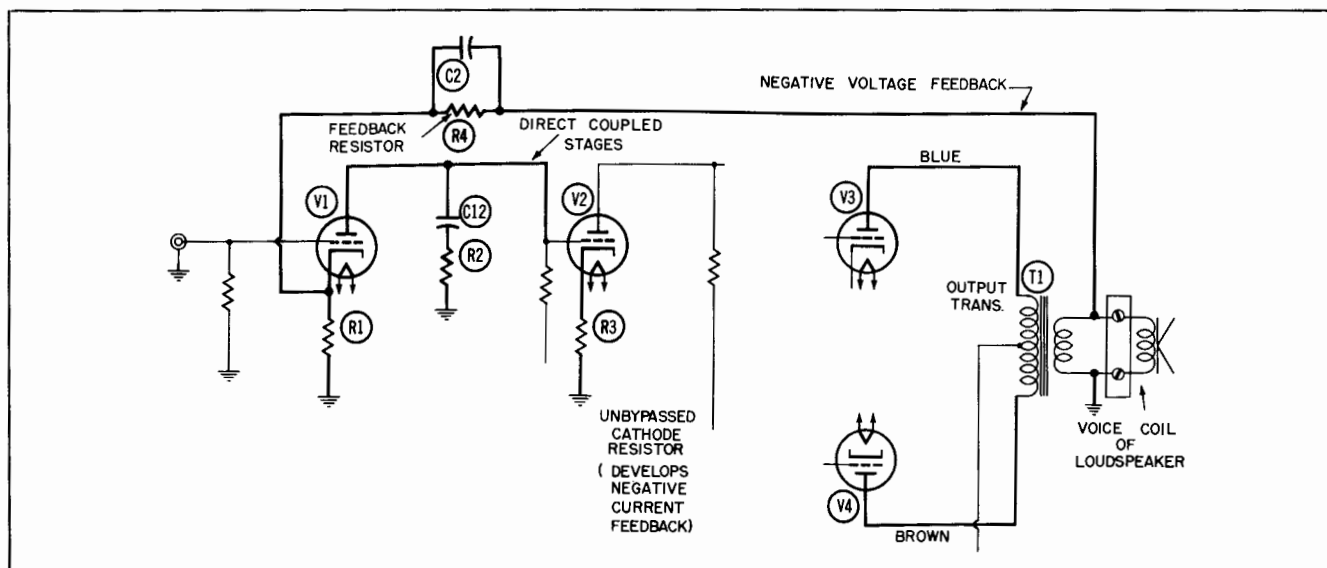


Fig. 12 shows a partial schematic of a typical amplifier circuit in which the output transformer is included in the negative-feedback loop. A portion of the signal voltage developed across the load (the voice coil of the loudspeaker) is fed back to the cathode of tube V1 in the input stage. The amount of signal fed back depends upon the resistance value of feedback resistor R4. A large value of resistance reduces the amount of feedback, while a low value increases the feedback.

The feedback signal must be 180° out of phase with the input signal to produce the desired effects on the output signal. While the 180° out-of-phase relationship can be maintained readily at midfrequencies, the extreme low and high ends of the frequency range present some difficulties.

Circuit components, particularly the output transformer and the coupling capacitors, tend to shift the signal phase at the extreme high and low frequencies. The phase can be shifted so far that the feedback becomes positive at high and low frequencies. This situation can cause the amplifier to become very unstable at the frequency extremes because positive feedback produces oscillations. The feedback may become positive only on signal peaks, and therefore, the oscillations may occur in bursts and at certain frequencies only. This condition can give rise to many peculiar and disturbing forms of distortion. Loudspeakers have been blamed for a rattling or buzzing sound, when the amplifier was actually at fault.

Various precautions are taken to prevent or at least reduce the phase shift and thereby stabilize the operation of the amplifier. Output transformers with sufficiently low leakage reactances are a necessity. Very large coupling capacitors are employed where required, or capacitors are eliminated altogether by direct coupling. Phase- and frequency-correction networks, such as resistor R2 and capacitor C1 in the plate circuit of V1 or capacitor C2 across feedback resistor R4, aid in stabilizing the amplifier.

Since the feedback signal must be 180° out of phase, the output transformer must be correctly phased in the circuit. For instance, if the plate leads of the transformer were reversed so that the blue lead went to the plate of V4 and the brown lead went to the plate of V3, the phase of the feedback signal would be reversed and would become positive. The amplifier would oscillate and produce a terrific roar or howl.

The feedback in the circuit we have been discussing is voltage feedback because the feedback signal is a portion of the signal voltage developed across the voice coil of the loudspeaker. The results from the use of negative feedback in this circuit are typical of the desirable effects of voltage feedback when it is applied properly. We can list them as follows:

- Distortion is reduced.
- Certain types of hum and noise are reduced.
- Output impedance is decreased.
- Loudspeaker damping is increased.
- The effects of the varying load presented to the amplifier by the loudspeaker are decreased.
- Frequency response is increased.

Tone controls should not be located inside a feedback loop because much of their effectiveness will

be nullified by negative feedback. This is one reason tone controls and other compensating circuits are usually located in another section of the audio system.

An unbypassed cathode resistor is another method of obtaining negative feedback. As an example, R3 in Fig. 2 produces current feedback. Some of the effects of current feedback are the same as those obtained with voltage feedback, while others are the opposite. Some of the characteristic effects of current feedback are:

- Distortion is reduced.
- Gain is reduced.
- Plate resistance of the stage in which the feedback is located is increased.
- Effect of load impedance on the output voltage is increased.
- Loudspeaker damping is decreased when current feedback is applied.

The damping applied to the loudspeaker can be controlled by varying the amount of feedback. The damping control circuit in Fig. 13 is a good example of this application of negative feedback. Two negative-feedback loops are used. One is voltage feedback, and the other is current feedback. The damping factor can be changed by varying the ratio of voltage feedback to current feedback.

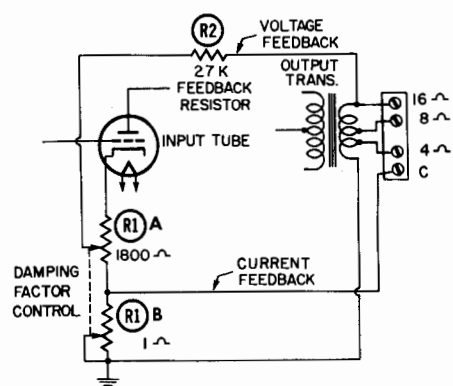


Fig. 13. Circuit using damping factor control.

Negative feedback is developed by the voltage-feedback loop connected from the top (or 16-ohm tap) of the output transformer through feedback resistor R2 to the moving contact of R1A in the cathode circuit of the input tube. When the moving contact is moved to the top or cathode end of R1A, negative voltage feedback will increase to maximum, and maximum damping action will be produced.

Negative feedback is developed in the current feedback circuit connected from the common (C) tap through R1B to ground. When the moving contact of R1B is moved toward the top or cathode end, current feedback will decrease because the resistance is reduced toward zero as R1B is progressively shorted to ground.

When R1B is moved in the opposite direction, current feedback is increased. Here we should recall that loudspeaker damping decreases as negative current feedback increases and that the damping increases when negative voltage feedback increases.

R1A and R1B are ganged and must turn together; therefore, when the damping-factor control tap is

moved to maximum (upward on the schematic), the negative voltage feedback produces the desired maximum damping factor, and no current feedback is produced because R1B is shorted.

When the damping control is set to the minimum position, minimum negative voltage feedback is developed, and the damping factor is reduced. But, in this minimum position, maximum negative current feedback is produced; and this, in turn, also reduces the damping factor. Thus, a large range of damping can be obtained; however, since negative feedback is always applied, distortion will be held to a minimum at any setting of the damping-factor control.

Negative feedback can be utilized by tone controls, compensation circuits for magnetic cartridges, and record-playback compensation circuits in phono preamplifiers to modify the frequency response of an amplifier. This action is possible because the negative-feedback loop can be frequency selective. The feedback network is so modified that certain frequencies are fed back while other frequencies are not. The frequencies that are fed back are attenuated because negative feedback reduces gain, but those that are not fed back are not attenuated and are effectively boosted.

Fig. 14 shows a typical phono-preamplifier circuit in which compensation (bass boost) is obtained with a frequency-selective feedback circuit. C1 (shunted across feedback resistor R1) and C2 (shunted by R2) offer very little opposition to the feedback of high frequencies; consequently, these frequencies are fed back and attenuated. The reactances of C1 and C2 become progressively greater as frequency is lowered, and therefore, the low frequencies are not subjected to as much loss and are effectively boosted. The

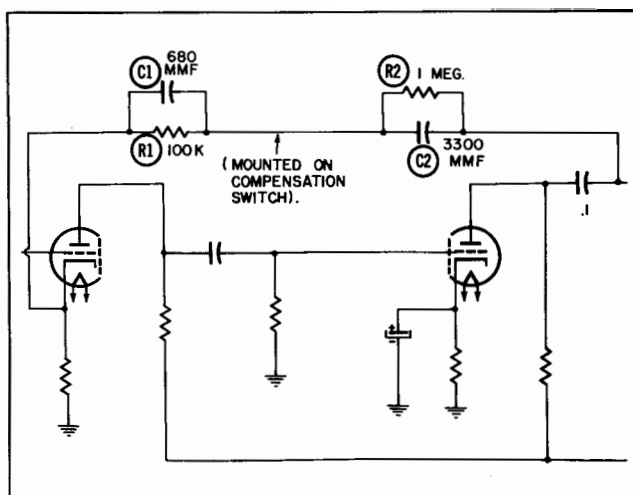
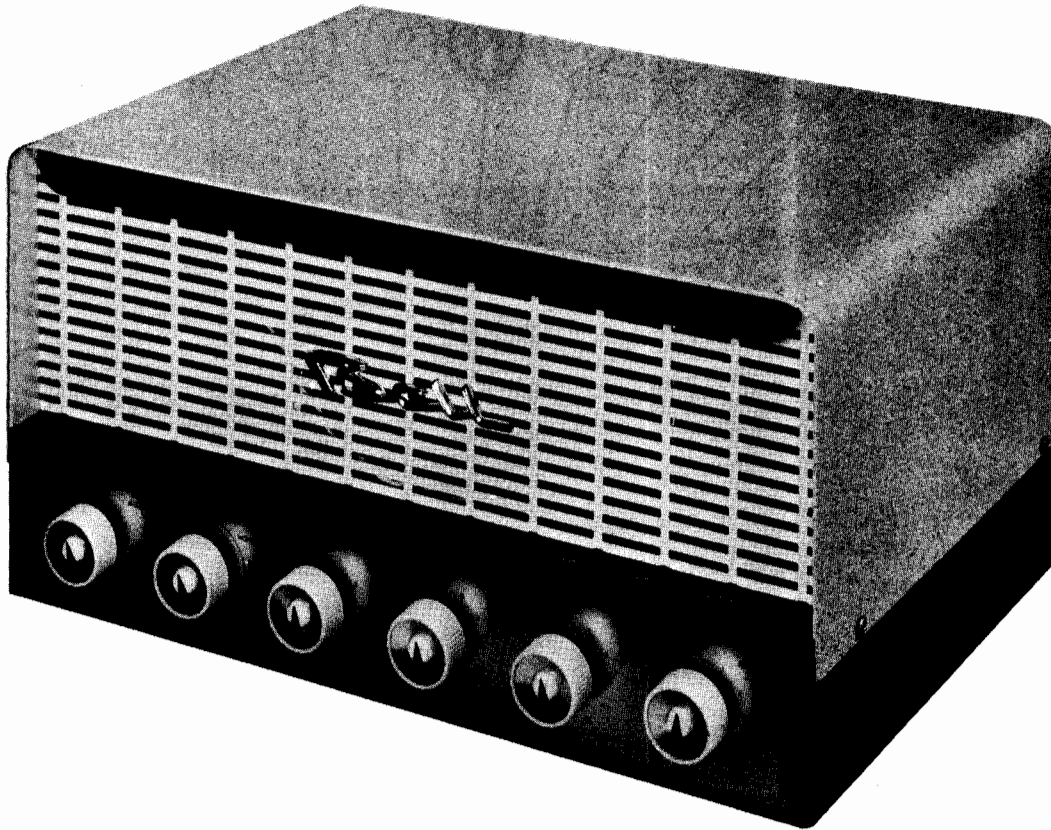


Fig. 14. Circuit using negative feedback for compensation.

compensation can be made to follow almost any desired curve if the appropriate network of resistors and capacitors is inserted in the feedback circuit. The values shown in Fig. 14 have been used for RIAA record compensation.

The same basic action is used with tone controls that employ negative feedback to control frequency response. A variety of such tone-control circuits are used, and some of them can appear to be very elaborate, but they all use the frequency-selective feedback action.

The definite advantage of negative feedback in equalizing circuits is that, in addition to the compensation obtained, distortion and noise are reduced by the action of the feedback.



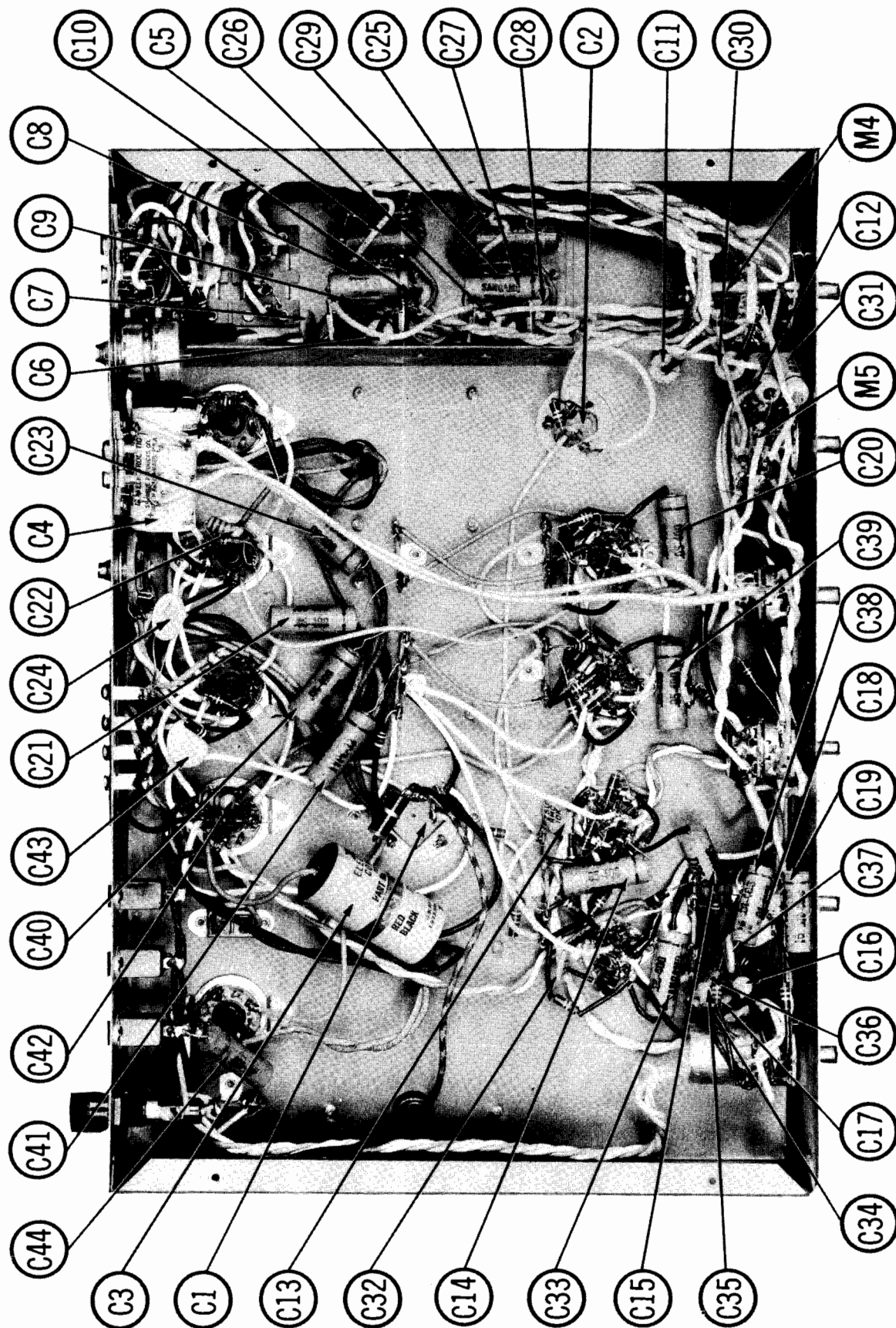
BELL SOUND
MODEL 3DT (G)

TRADE NAME	Bell Sound Model 3DT (G)	
MANUFACTURER	Bell Sound Systems, Inc., 555 Marion Road, Columbus 7, Ohio.	
TYPE SET	AC Operated 8 Channel Binaural Amplifier	
TUBES	Eleven	
POWER SUPPLY	110-120 Volts AC-60 Cycles	RATING 1.1 Amp@117 Volts AC (120 Watts)

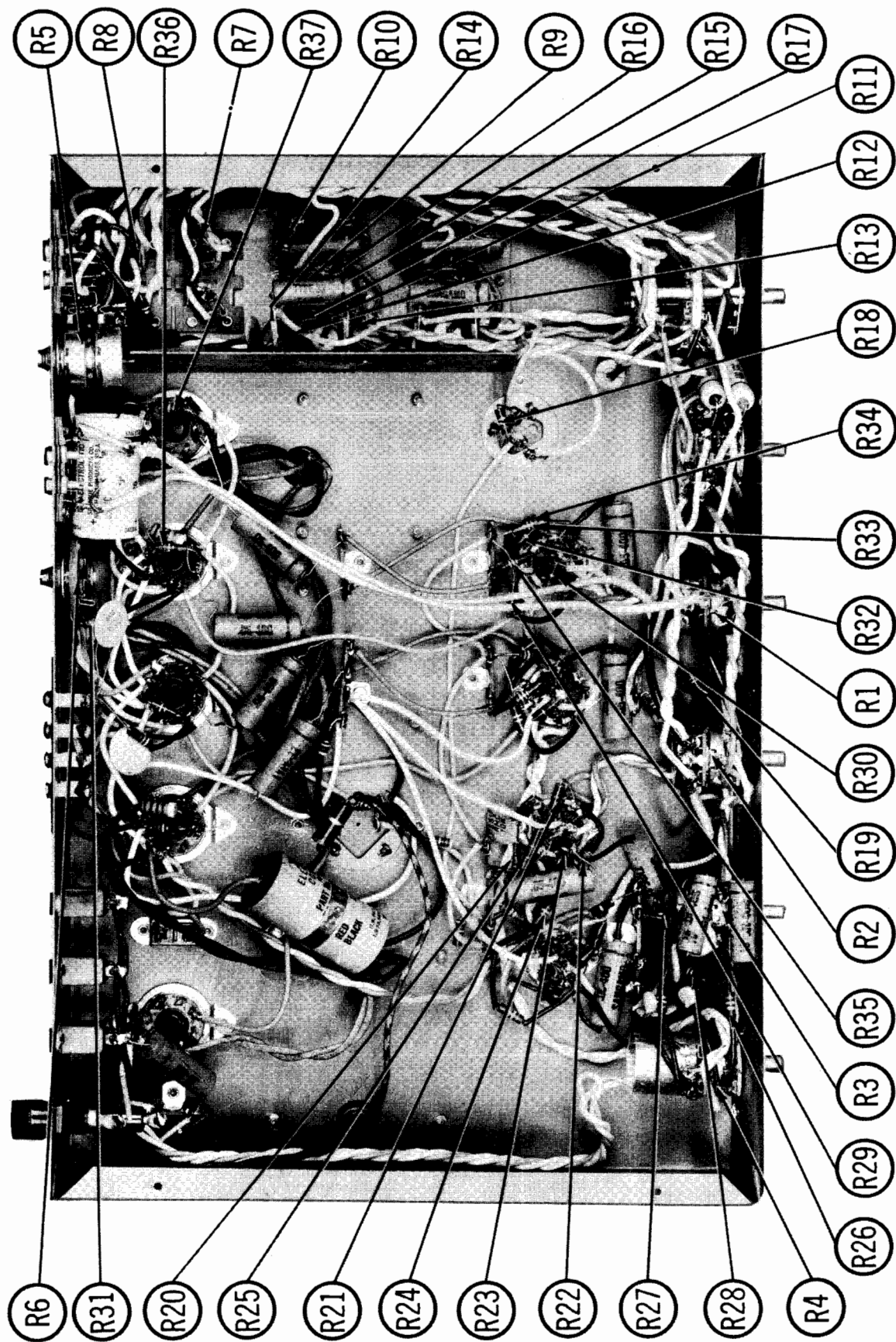
HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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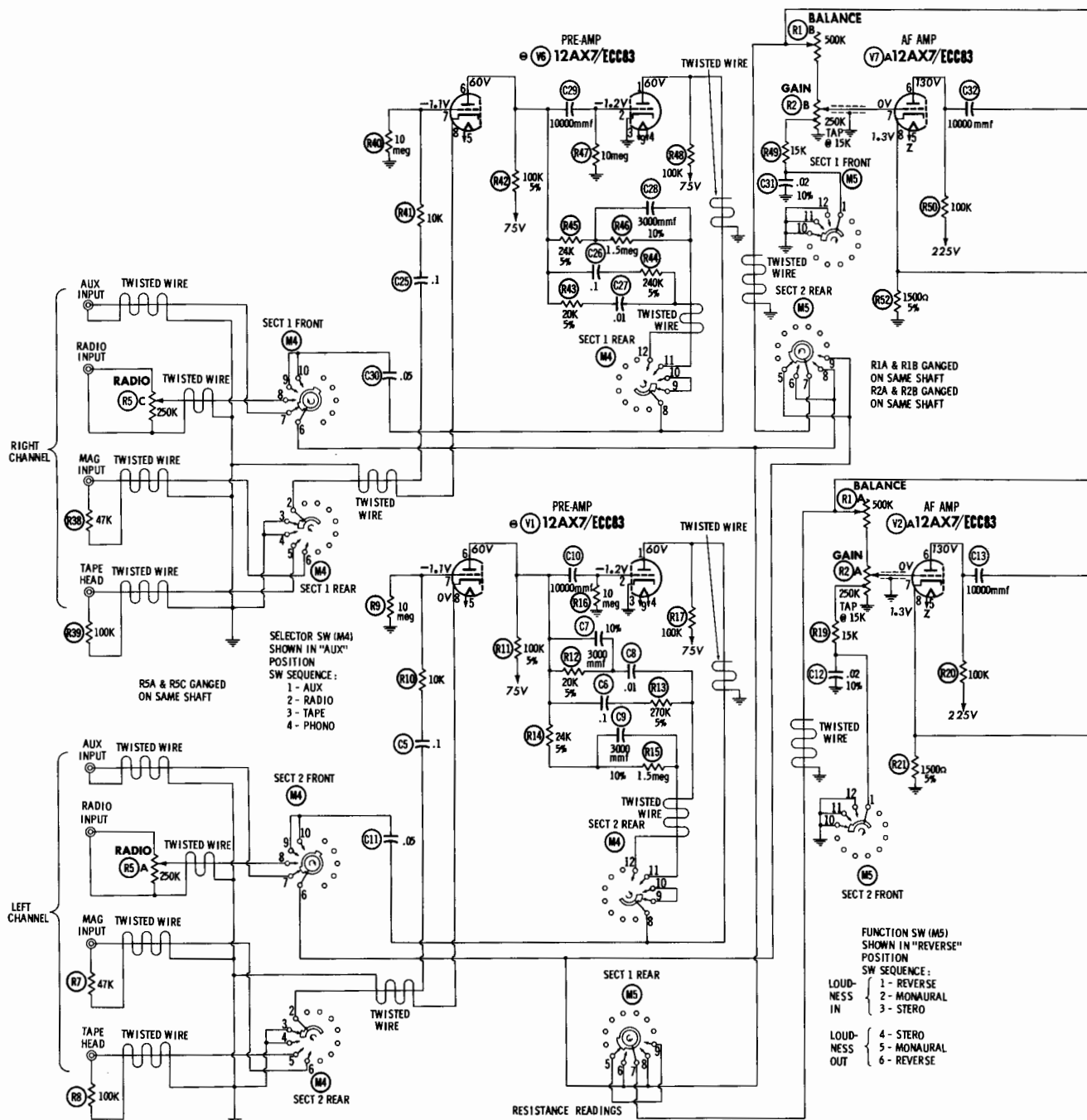
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CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION



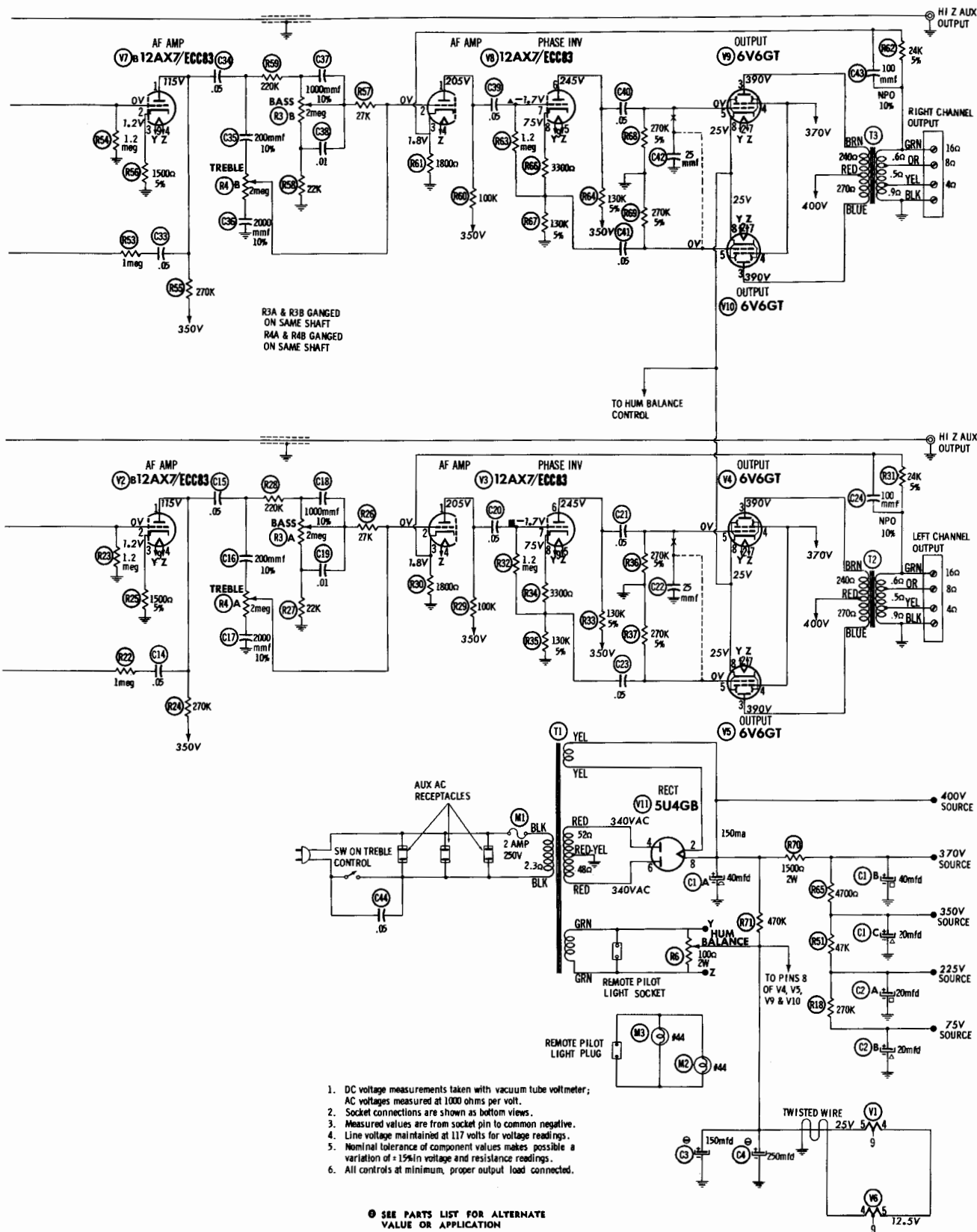
CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

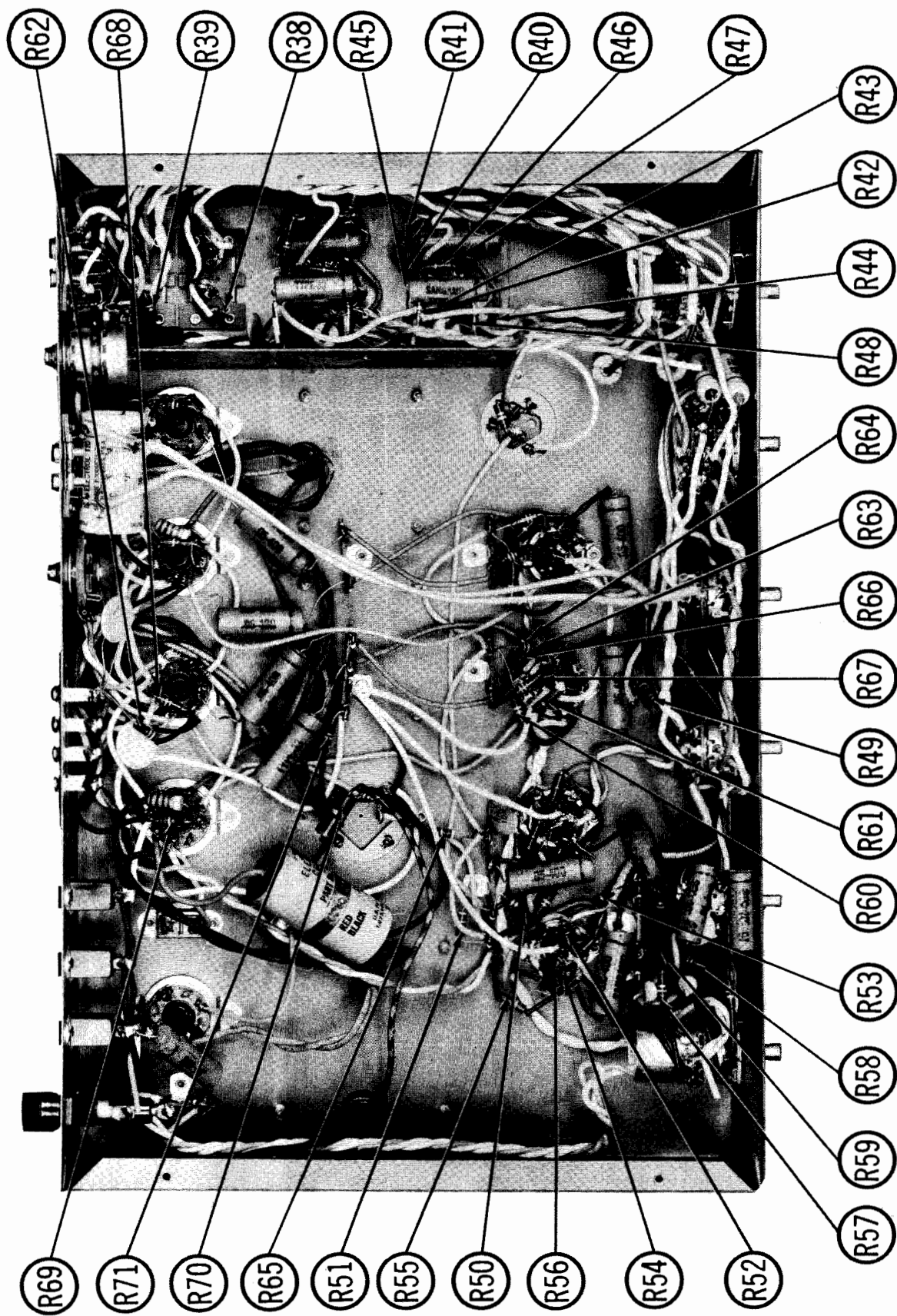


† MEASURED FROM PIN 8 OF V1
■ MEASURED FROM PIN 8 OF V3
▲ MEASURED FROM PIN 8 OF V8
NC NO CONNECTION
TP TIE POINT

A PHOTOFAC STANDARD NOTATION SCHEMATIC
Howard W. Sams & Co., Inc. 1958

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7 ECC83	† 420K	10meg	0a	15a	30a	† 420K	10meg	0a	NC
V2	12AX7 ECC83	† 270K	1.2meg	1500a	50a	50a	† 150K	0a	1500a	50a
V3	12AX7 ECC83	† 100K	8500a	1800a	50a	50a	† 130K	1.3meg	130K	50a
V4	6V6GT	0a	50a	† 240a	† 1500a	270K	TP	50a	30a	
V5	6V6GT	0a	50a	† 270a	† 1500a	270K	NC	50a	30a	
V6	12AX7 ECC83	† 420K	10meg	0a	0a	15a	† 420K	10meg	0a	NC
V7	12AX7 ECC83	† 270K	1.2meg	1500a	50a	50a	† 150K	0a	1500a	50a
V8	12AX7 ECC83	† 100K	49K	1600a	50a	50a	† 130K	1.3meg	130K	50a
V9	6V6GT	0a	50a	† 240a	† 1500a	270K	TP	50a	30a	
V10	6V6GT	0a	50a	† 270a	† 1500a	270K	NC	50a	30a	
V11	5U4GB	NC	20K(MIN)	NC	52a	NC	48a	NC	20K(MIN)	





CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

PARTS LIST AND DESCRIPTIONS TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE
V1	Left Channel Preamp.	12AX7/ECC83 ①
V2	AF Amplifier	12AX7/ECC83
V3	AF Amp. -Phase Inv.	12AX7/ECC83
V4	Output	6V6GT
V5	Output	6V6GT
V6	Rectifier	5U4GB

① Some versions may use 12AX7 in this application

ELECTROLYTIC CAPACITORS

ITEM No.	RATING	REPLACEMENT DATA	SPRAGUE PART No.
	CAP.		
C1A	40	AFH3-43-50	FP378.9
C1B	40	AFH2-51	FP234
C1C	40	AFH2-51	FP234
C2A	20	PR850V150	TC485
C2B	20	PR850V150	TC50025
C3	150	PR850V250	BR1505
C4	250	PR850V250	BR2505

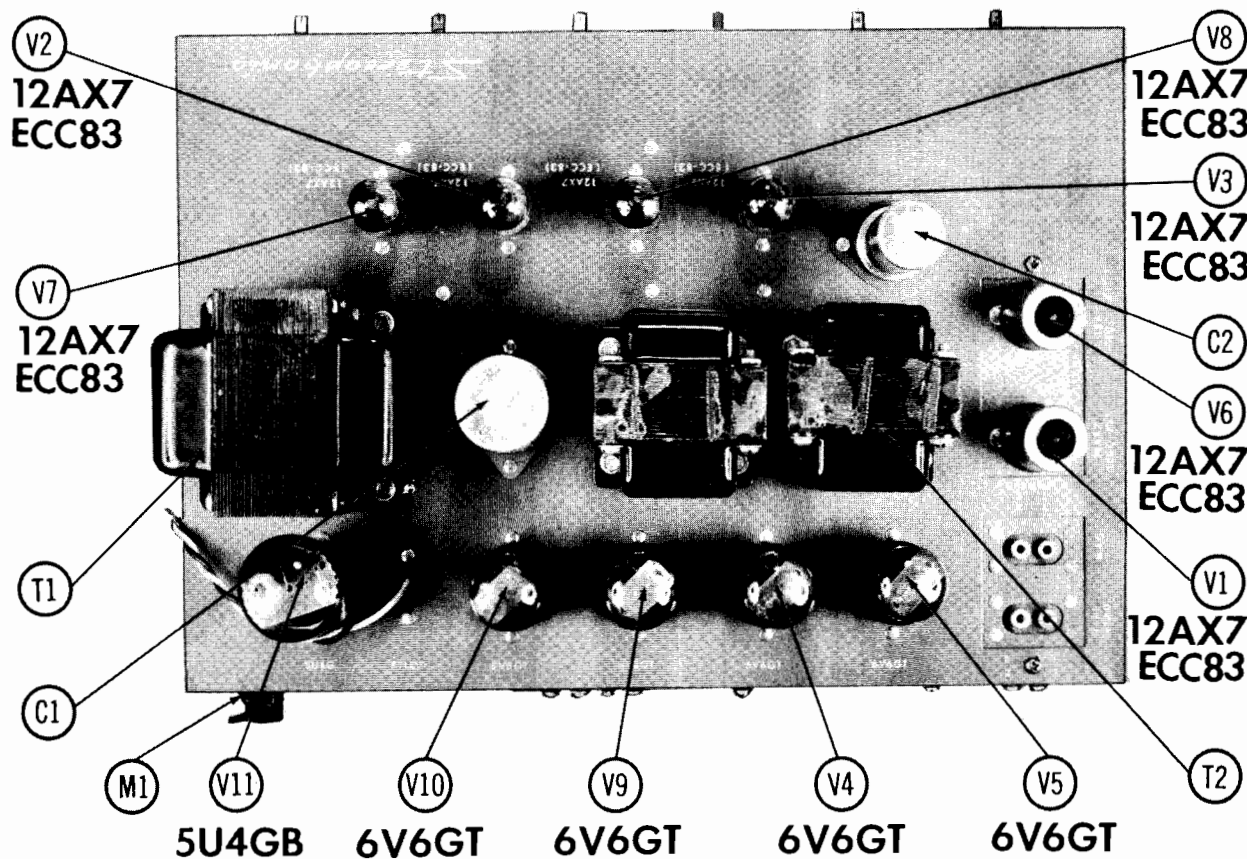
① When C3 is 500mfd, C4 is not used

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING	REPLACEMENT DATA	SPRAGUE PART No.	NOTES
	CAP.			
C5	.1	P288N-1	DM-201	10%
C6	.1	P288N-1	DM-201	10%
C7	3000	P288N-1	DM-201	10%
C8	.01	P488N-01	DM-201	10%
C9	3000	P488N-01	DM-201	10%
C10	10000	P488N-01	DM-201	10%
C11	.02	P488N-02	DM-201	10%
C12	.02	P488N-02	DM-201	10%
C13	10000	P488N-02	DM-201	10%
C14	.05	P488N-05	DM-201	10%
C15	.05	P488N-05	DM-201	10%
C16	200	P488N-05	DM-201	10%
C17	2000	P488N-05	DM-201	10%
C18	1000	P488N-05	DM-201	10%
C19	.01	P488N-01	DM-201	10%
C20	.05	P488N-05	DM-201	10%
C21	.05	P488N-05	DM-201	10%
C22	25	P488N-05	DM-201	10%
C23	.05	P488N-05	DM-201	10%
C24	100	P488N-05	DM-201	10%
C25	.1	P488N-05	DM-201	10%
C26	.1	P488N-05	DM-201	10%
C27	.01	P488N-01	DM-201	10%
C28	3000	P488N-05	DM-201	10%
C29	10000	P488N-05	DM-201	10%
C30	.05	P488N-05	DM-201	10%
C31	.02	P488N-02	DM-201	10%
C32	.05	P488N-05	DM-201	10%
C33	.05	P488N-05	DM-201	10%
C34	200	P488N-05	DM-201	10%
C35	200	P488N-05	DM-201	10%
C36	2000	P488N-05	DM-201	10%
C37	1000	P488N-05	DM-201	10%
C38	.01	P488N-01	DM-201	10%
C39	.05	P488N-05	DM-201	10%
C40	.05	P488N-05	DM-201	10%
C41	.05	P488N-05	DM-201	10%
C42	25	P488N-05	DM-201	10%
C43	100	P488N-05	DM-201	10%
C44	.05	P488N-05	DM-201	10%

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA								NOTES
	PRI	SEC.	Bell Sound PART No.	Halldorson PART No.	Merit PART No.	Ram PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.		
T2	65000 CT	160 Tap @ 80 & 40	B-20374					A-3304	22588 ①		① Tape 25001 & 5000 taps
T3	65000 CT	160 Tap @ 80 & 40	B20374					A-3304	22588 ①		

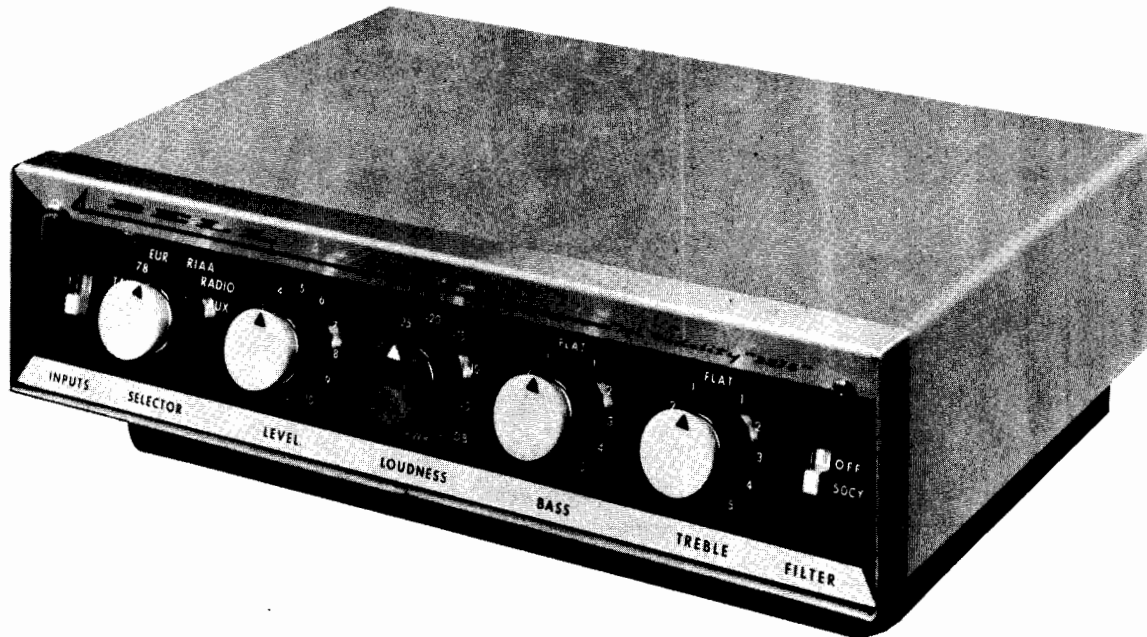
ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			Bell Sound		LITTELFUSE		BUSS	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M1	3AG	2A 250V			312002. (3AG 2A 250V)	342001	AGC2	HKP

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	PART NAME	Bell Sound PART No.	NOTES
M2	Pilot Lamp		444
M3	Pilot Lamp		444
M4	Switch		Selector (Input) (Rotary wafer type)
M5	Switch		Function (Rotary wafer type)

General-use Unshielded Hook-up Wire Use BELDEN No. 8530 (Solid) Available in Ten Colors
8534 (Stranded) Available in Ten Colors
Power Cord Use BELDEN No. 1765-B (6 Ft. Length)
1725-K (7½ Ft. Length)
Low-Loss Shielded Lead (Interconnecting) Use BELDEN No. 8401
Phone Pick-up Arm Cable Use BELDEN No. 8430 (Two Conductor - Twisted)

[illegible]



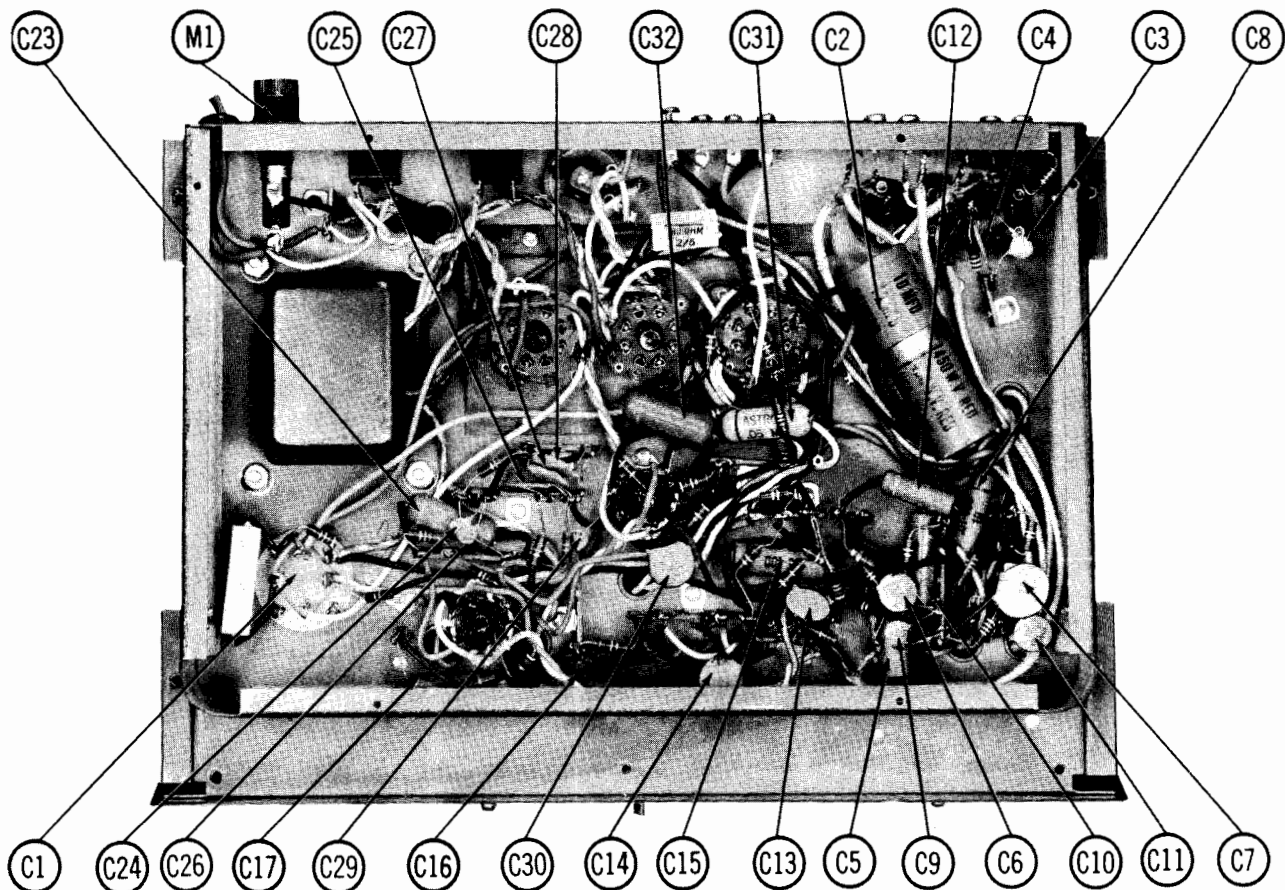
TRADE NAME	Bell Sound Model 2315	
MANUFACTURER	Bell Sound Systems, Inc., 555 Marion Road, Columbus 7, Ohio	
TYPE SET	AC Operated 6 Channel 12 Watt Audio Amplifier	
TUBES (Six)	Types 12AX7/ECC83 Phono Preamplifier, 12AX7/ECC83 AF Amplifier, 12AX7/ECC83 AF Amp - Phase Inv., (2) 6V6GT Output, 5Y3GT Rectifier	
POWER SUPPLY	110-120 Volts AC -60 Cycles	RATING .74 Amp. @ 117 Volts AC (75 Watts)

BELL SOUND
MODEL 2315

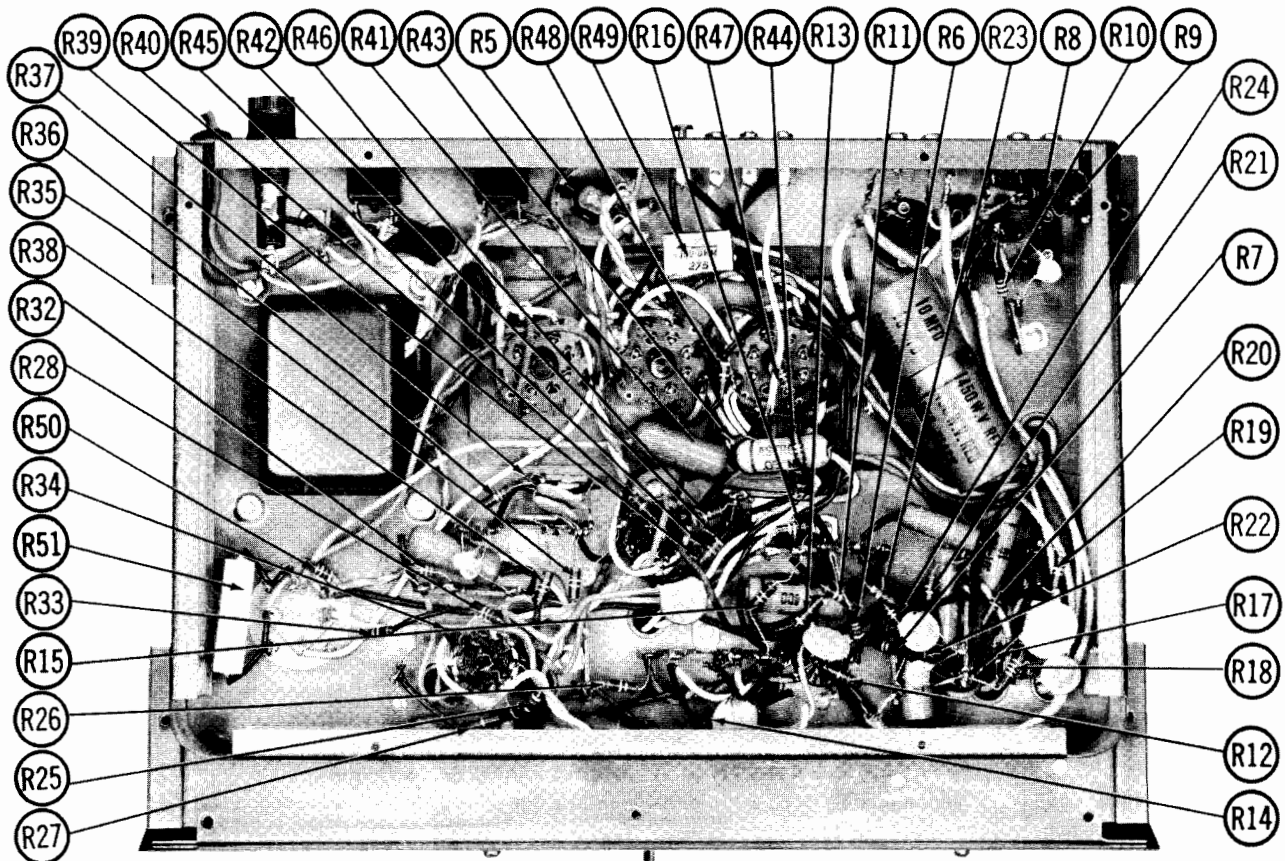
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CHASSIS BOTTOM VIEW CAPACITOR AND MISCELLANEOUS IDENTIFICATION



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

PARTS LIST AND DESCRIPTIONS TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE
V1	Phono Pre-amplifier	12AX7/ECC83
V2	AF Amplifier	12AX7/ECC83
V3	AF Amp. - Phase Inv.	12AX7/ECC83

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA				
	CAP.	VOLT.	BELL SOUND PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.
C1A	40	450					
B	15	450					
C	10	450					
D	100	50					
C2A	10	450		PRS450V1010	BERTEL145	TCD72	MTD-4510
B	10	450					TVA-2722

* Non Catalog Item

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

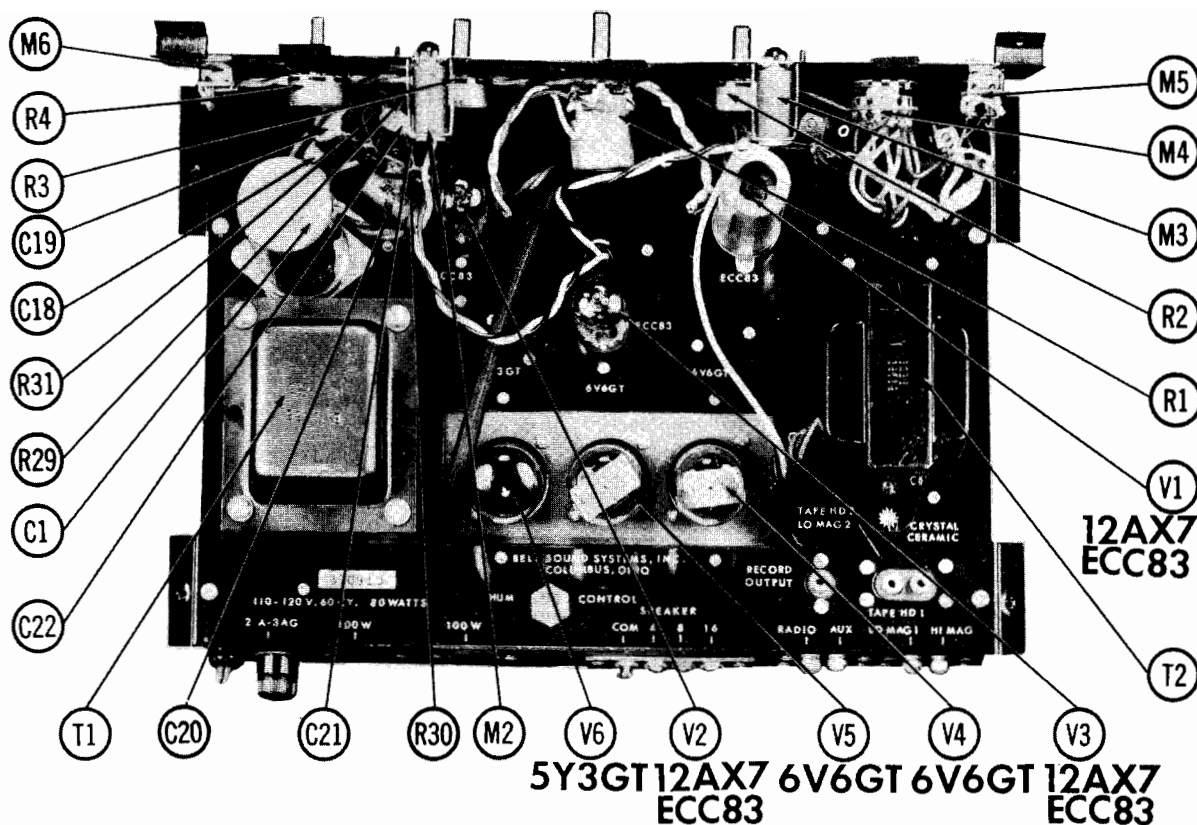
ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT.	BELL SOUND PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C3	200				TCZ-200	L1072	ED-200	MCB237	MS-32	10% NPO
C4	68			NPO-DI 68	TCZ-68	C10Q88C	TCO-68	GEM-415	STCC-Q88	10% NPO
C5	.05	400		P488N-05	DF-603	CUB4S5			4TM-S5	
C6	2400					LRSD24	CY20C242T	MCB465	MS-224	10%
C7	5000					LRSD5		GEM-18L1	MS-25	10%
C8	.01	400			D6-471	SR5T47	ED-470		MS-324	10%
C9	.025	400				LRSD24	CY20C242T	GEM-18L1	MS-224	10%
C10	.025	400						DC511	5HK-S1	10%
C11	2400				DD-103	BYA6S1	ED-01	DC511	5HK-S1	10%
C12	.01	400		BPD-01	DD-103	BYA6S1	ED-01	GEM-415	4TM-S5	10%
C13	10000				D -503	CUB4S5		GEM-201	2TM-P1	10%
C14	10000				P288N-1	LR-104	CUB2P1	GEM-415	4TM-S5	10%
C15	.05	400			DF-603	CUB4S5		GEM-415	4TM-S5	10%
C16	.1	200			D6-241	L10724	ED-240		MS-324	10%
C17	.05	400				LRSD24	CY20C242T	GEM-18L1	MS-224	10%
C18	2400				TCZ-68	C10Q88C	TCO-68	MCB255	STCC-Q88	10% NPO
C19	2400				DF-104	CUB2P1		GEM-201	2TM-P1	10%
C20	.01	400		NPO-DI 68	D6-471	SR5T47	ED-470	DC511	5HK-S1	10%
C21	1000			P288N-1	DD-103	BYA6S1	ED-01	DC511	5HK-S1	10%
C22	68	200		BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	10%
C23	.1				DD-103	BYA6S1	ED-01	DC511	5HK-S1	10%
C24	470				DD-103	BYA6S1	ED-01	DC511	5HK-S1	10%
C25	10000				DD-103	BYA6S1	ED-01	DC511	5HK-S1	10%
C26	470				DD-103	BYA6S1	ED-01	DC511	5HK-S1	10%
C27	10000				DD-103	BYA6S1	ED-01	DC511	5HK-S1	10%
C28	10000				DD-103	BYA6S1	ED-01	DC511	5HK-S1	10%
C29	270				DD-103	BYA6S1	ED-01	DC511	5HK-S1	10%
C30	10000				DD-103	BYA6S1	ED-01	DC511	5HK-S1	10%
C31	.05	400			DD-103	BYA6S1	ED-01	DC511	5HK-S1	10%
C32	.05	400			DD-103	BYA6S1	ED-01	DC511	5HK-S1	10%

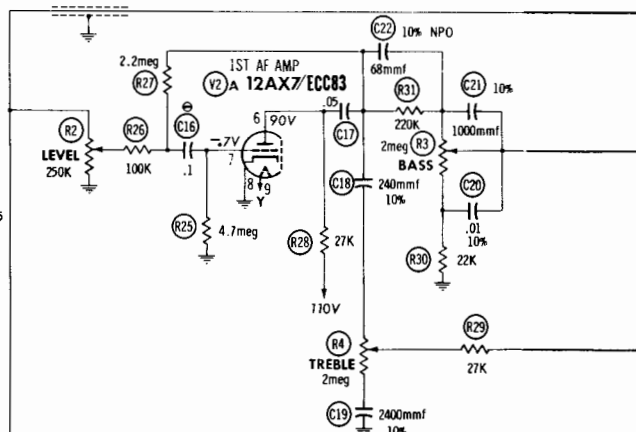
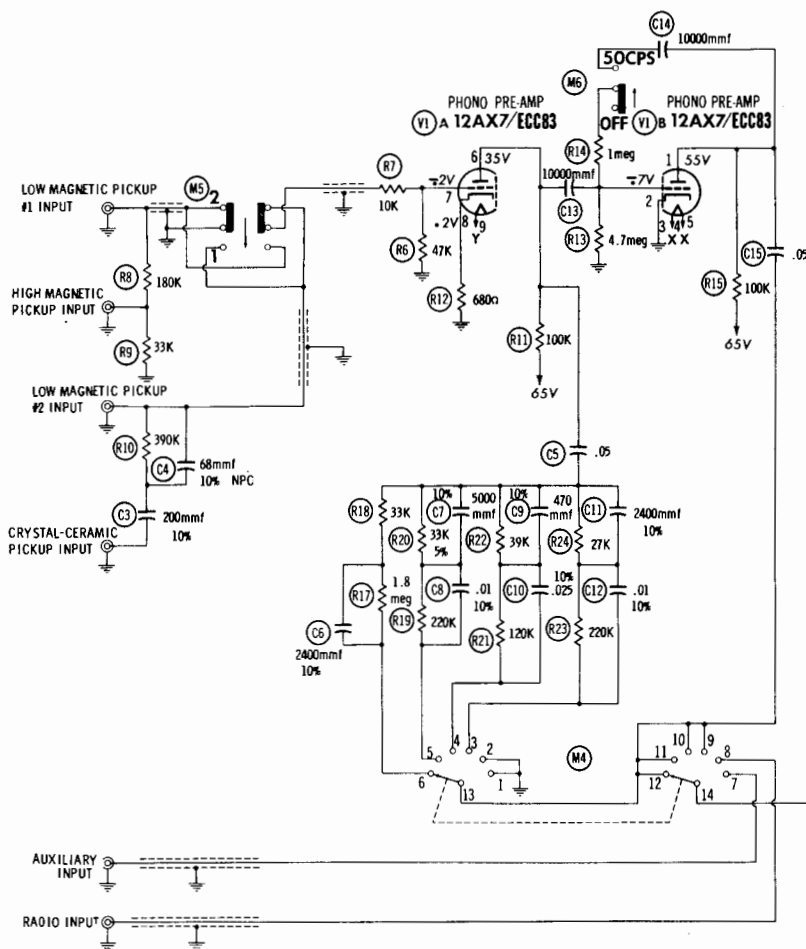
Note 1. Some versions may use .01mfd in this application.

CONTROLS

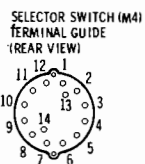
ITEM No.	RATING		REPLACEMENT DATA				INSTALLATION NOTES	
	RESISTANCE	WATTS	BELL SOUND PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	250K	1	B-20046P164	B-50	A47-250K-S	Q11-130	U46	Loudness, Tap @ 100K & 150K
R2A	250K	1	B-20046P162	Not Req.	FR-3	Not Req.	U46	Level
R3A	2meg	1	B-20046P159	Not Req.	A47-2meg-Z	Q13-139	U55	Bass
B	Shaft				FR-3	Not Req.		

CHASSIS—TOP VIEW





SELECTOR SWITCH (M4)
SHOWN IN TAPE
POSITION.
SWITCH SEQUENCE:
1. TAPE
2. 78
3. EUR
4. AIAA
5. RADIO
6. AUX.



1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of $\pm 15\%$ in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

SEE PARTS LIST FOR ALTERNATE
VALUE OR APPLICATION

RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7 ECC83	$\dagger 330K$	4.7meg	0 ∞	300 Ω	300 Ω	$\dagger 330K$	47K	680 Ω	300 Ω
V2	12AX7 ECC83	$\dagger 160K$	22K	820 Ω	300 Ω	300 Ω	$\dagger 160K$	4.7meg	0 ∞	300 Ω
V3	12AX7 ECC83	$\dagger 500K$	100K	4200 Ω	300 Ω	300 Ω	$\dagger 500K$	2.7meg	470K	300 Ω
V4	6V6GT	TP	300 Ω	$\dagger 390\Omega$	$\dagger 6800\Omega$	470K	TP	300 Ω	275 Ω	
V5	6V6GT	TP	300 Ω	$\dagger 360\Omega$	$\dagger 6800\Omega$	470K	NC	300 Ω	275 Ω	
V6	5Y3GT	NC	20K(Min)	NC	170 Ω	NC	160 Ω	NC	20K(Min)	

$\dagger$ MEASURED FROM PIN 8 OF V6
 ∞ MEASURED FROM PIN 8 OF V3
 NC NO CONNECTION
 TP TIE POINT

CONTROLS (cont)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

All wattages 1/2 watt, or less, unless otherwise listed.

All wattages 1/2 watt, or less, unless otherwise listed.

TRANSFORMER (POWER)

TRANSFORMER (POWER)

② Tape center tap on 6.3V winding.

② Tape center tap on 6.3V winding.

TRANSFORMER (AUDIO OUTPUT)

[illegible]

REPLACEMENT DATA

1000

DATE	DESCRIPTION	AMOUNT	NOTES
10/1/2023	Initial deposit	100.00	
10/15/2023	Withdrawal	25.00	
11/1/2023	Deposit	50.00	
11/15/2023	Withdrawal	10.00	
12/1/2023	Deposit	75.00	
12/15/2023	Withdrawal	30.00	
1/1/2024	Deposit	120.00	
1/15/2024	Withdrawal	40.00	
2/1/2024	Deposit	90.00	
2/15/2024	Withdrawal	15.00	
3/1/2024	Deposit	60.00	
3/15/2024	Withdrawal	20.00	
3/31/2024	Balance	300.00	

.....Use BEL

[illegible]



CHALLENGER
MODELS CHA33, CHA33Y

TRADE NAME	Challenger Models CHA33, CHA33Y	
MANUFACTURER	Challenger Amplifier Co., P. O. Box 500, Paramus, N. J.	
TYPE SET	AC Operated 3 Channel 33 Watt Audio Amplifier (Model CHA33Y has 3 Speed Manual Record Player)	
TUBES (Seven)	Types 12AX7/ ECC83 Mic 1-Mic 2 Preamplifier, 6AV6 Mixer, 12AX7/ ECC83 AF Amp. -Phase Inv., (2) 6L6GB Output, (2) 5Y3GT Rectifier	
POWER SUPPLY	110-120 Volt AC-60 Cycle	RATING 1.1 Amp. @117 Volt AC (120Watts)

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PARTS LIST AND DESCRIPTIONS TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE
V1	Mic 1-Mic 2 Preamplifier	12AX7/ ECC83
V2	Mixer	6AV6
V3	AF Amp. -Phase Inv.	12AX7/ ECC83
V4	Output	6L6GB

ITEM No.	USE	TYPE
V5	Output	6L6GB
V6	Rectifier	5Y3GT
V7	Rectifier	5Y3GT

ELECTROLYTIC CAPACITORS

ITEM No.	RATING CAP.	VOLT.	REPLACEMENT DATA			
			CHALLENGER PART No.	AEROVOX PART No.	CORNELL-DUBIER PART No.	MALLORY PART No.
C1	16	500		AFH-59	BR850	WP433. 6
C2	5	450		AFH4-09	D0080	TMD-61
C3	50	50		PR550V50	BR505	TC39
						TD-50-50
						MT-0550
						TVA-1308

FIXED CAPACITORS

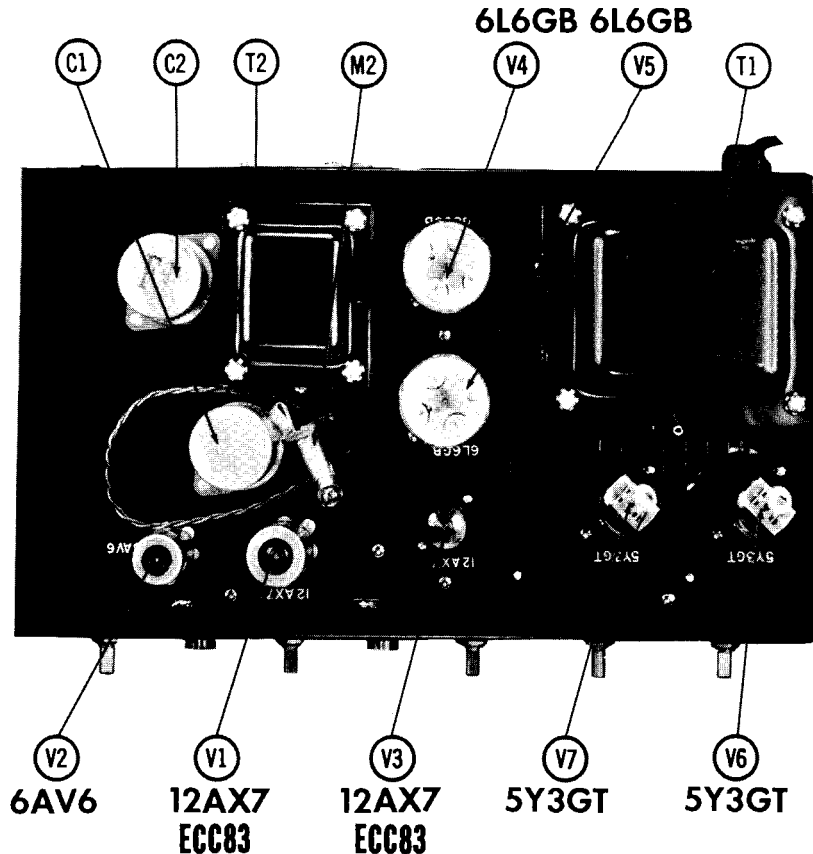
Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP.	VOLT	REPLACEMENT DATA					NOTES
			CHALLENGER PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBIER PART No.	ERIE PART No.	
C4	.033	200		P288N-033	DF-303	CUB6S33	GEM-4133	6TM-S33
C5	.033	400		P488N-033	DF-303	CUB6S33	GEM-4133	6TM-S33
C6	.033	200		P288N-033	DF-303	CUB6S33	GEM-4133	6TM-S33
C7	.033	400		P488N-033	DF-303	CUB6S33	GEM-4133	6TM-S33
C8	.1	400		P488N-1	DF-104	CUB4F1	GEM-401	4TM-P1
C9	.270	200			D6-271	5R5T27	ED-270	MS-327
C10	2200	200				IR5D22	CY20C222K	MS-222
C11	1000	200				IR5D1	ED-1000	MS-21
C12	.0056	200		D6-562			GP-5600	
C13	.033	200		P288N-033	DF-303	CUB6S33	GEM-4133	6TM-S33
C14	15000	5000		BPD-015	DD16-153	BYA10815	ED-015	5HK-S15
C15	.033	400		P488N-033	DF-303	CUB6S33	GEM-4133	6TM-S33
C16	.033	400		P488N-033	DF-303	CUB6S33	GEM-4133	6TM-S33
C17	2200	400				IR5D22	CY20C222K	MS-222

CONTROLS

ITEM No.	RATING RESIST.	WATTS	REPLACEMENT DATA				INSTALLATION NOTES
			CHALLENGER PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	
R1A	2meg	1	V417	B-76	A47-2meg-Z	Q13-139	Treble
B	Shatt			Not Req.	FS-3	Not Req.	
C	Switch			KB-1	SWE-12	78-1	Not Req.
R2A	2meg	1	V413	B-76	A47-2meg-Z	Q13-139	Not Req.
B	Shatt			Not Req.	FS-3	Not Req.	
R3A	500K	1	V387	B-60	A47-500K-Z	Q13-133	Not Req.
B	Shatt			Not Req.	FS-3	Not Req.	
R4A	500K	1	V387	B-60	A47-500K-Z	Q13-133	Not Req.
B	Shatt			Not Req.	FS-3	Not Req.	
R5A	500K	1	V387	B-60	A47-500K-Z	Q13-133	Not Req.
B	Shatt			Not Req.	FS-3	Not Req.	

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		CHALLENGER PART No.	NOTES
	OHMS	WATT		
R6	3.3meg			
R7	220K			
R8	3.3meg			
R9	220K			
R10	220K			
R11	220K			
R12	270K			
R13	220K			
R14	470K			
R15	220K			
R16	100K			
R17	33K			
R18	47K			
R19	220K			
R20	220K			
R21	390K			

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA			
	SEC. 1		SEC. 2		CHALLENGER PART No.	Haldorson PART No.	Merit PART No.	Stancor PART No.
	PRI.	117V	800VCT	5V				
T1	② 1.1A	③ 130A	④ 4A	⑤ 2.8A	T385-2			

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC. 1	CHALLENGER PART No.	Haldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	
T2	8000Ω	70V	T279-1						
	CT								
			SEC. 2						
			180T-4p						
			④						
			802.6 4Ω						

FUSES

ITEM No.	TYPE	RATING		REPLACEMENT DATA			
		FUSE	HOLDER	CHALLENGER PART No.	LITTELFUSE PART No.	FUSE	HOLDER
M1	3AG	2A 250V	S/B		313002	342001	MDL2

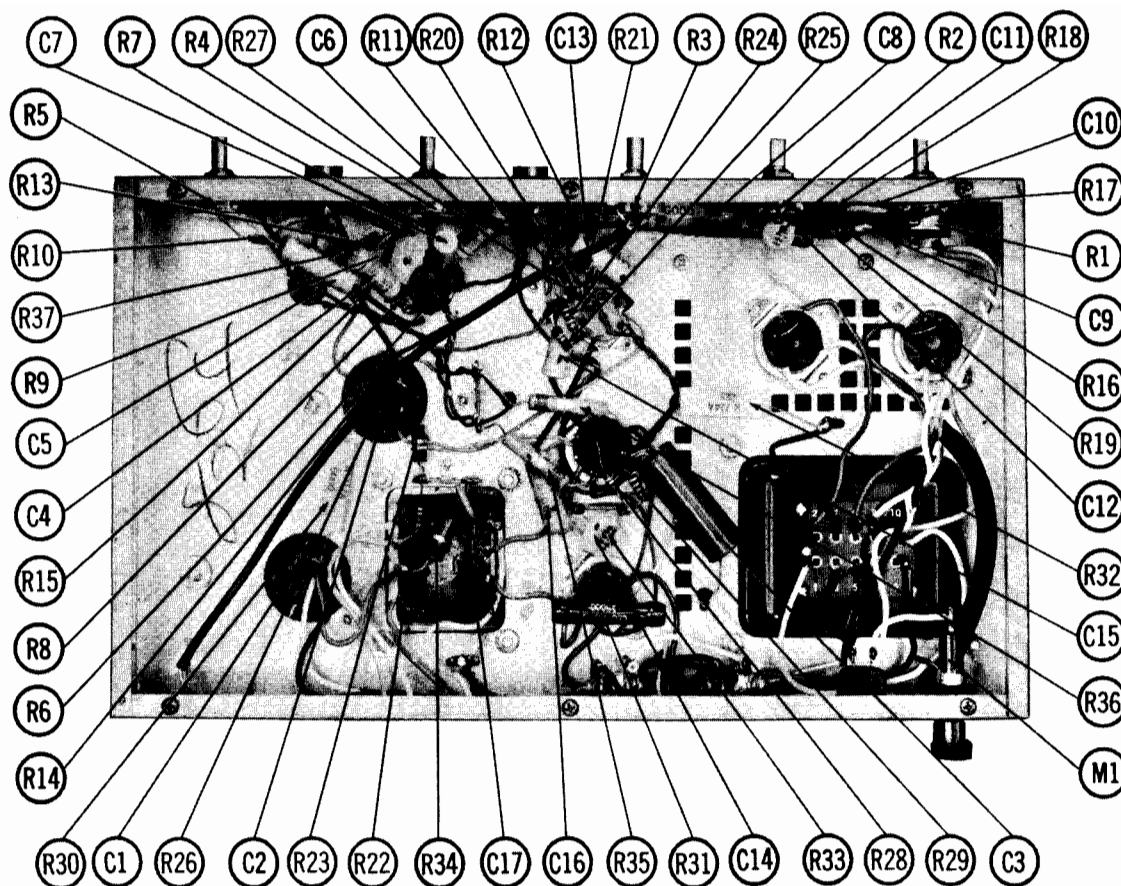
MISCELLANEOUS

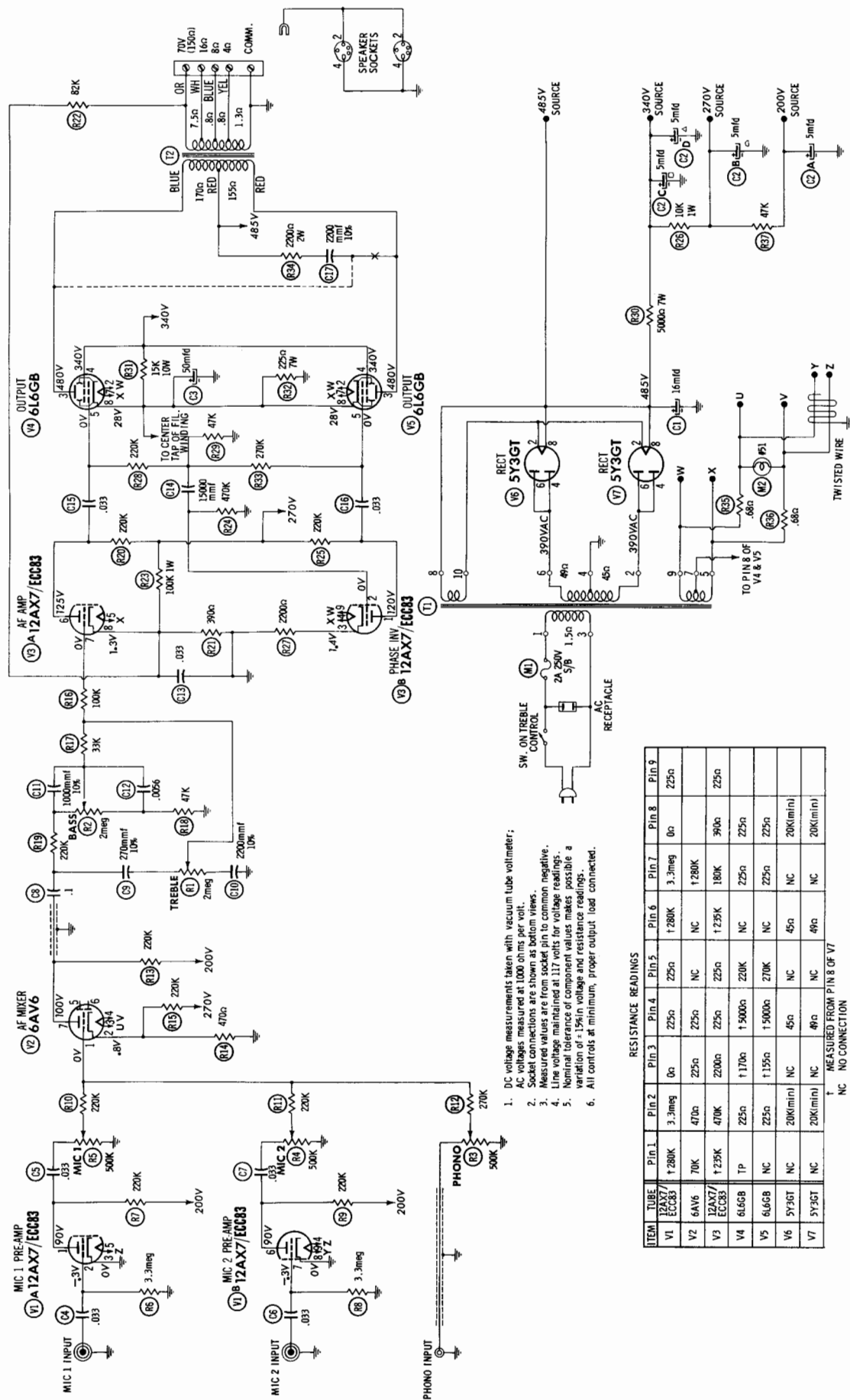
ITEM No.	PART NAME	CHALLENGER PART No.	NOTES
M2	Pilot Lamp	#51	

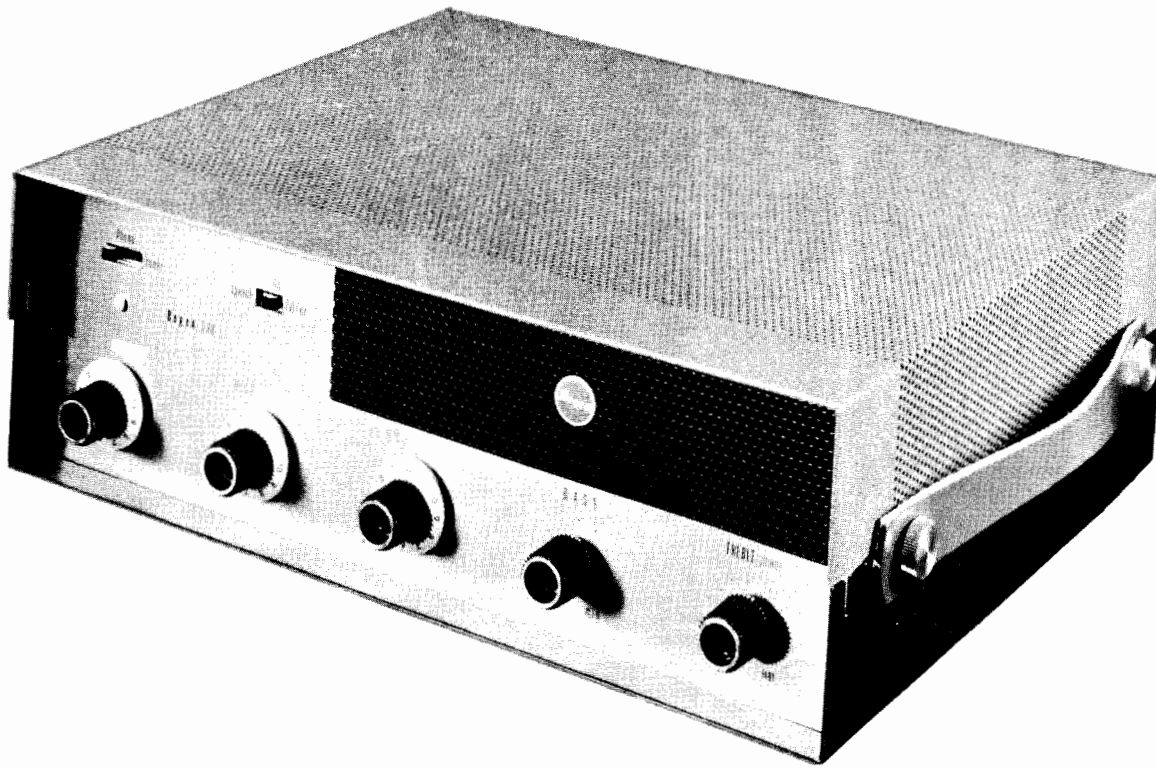
WIRING DATA

General-use Unshielded Hook-up Wire	Use BELDEN No. 8530 (Solid) Available in Ten Colors
Power Cord	8524 (Stranded) Available in Ten Colors
Low-Loss Shielded Lead (Interconnecting)	1786-B (6 Ft. Length)
Photo Pick-up Arm Cable	1786-K (7 1/2 Ft. Length)
	Use BELDEN No. 9401
	Use BELDEN No. 8430 (Two Conductor - Twisted)

CHASSIS—BOTTOM VIEW







DAVID BOGEN
MODEL L60

TRADE NAME	David Bogen Model L60	
MANUFACTURER	David Bogen Co., Inc. P. O. Box 500, Paramus, N. J.	
TYPE SET	AC Operated 6 Channel 60 Watt Audio Amplifier	
TUBES	Twelve	
POWER SUPPLY	110-120 Volts AC-60 Cycle	RATING 1.1 Amp. @ 117 Volts AC (130 Watts)

VOLTAGE REGULATOR ADJUSTMENT (R6)

The voltage regulator (R6) should be adjusted if V5, V6, V7, V8 or V9 tubes are replaced.

1. Set "Volt Reg." Control (R6) and volume controls (R1, R2, R3) at minimum. Allow the amplifier to warm up for four minutes.

2. Using an accurate low range DC voltmeter, connect the positive lead to terminal 1 of the "CUR MON" test strip. Connect the negative lead to ground.

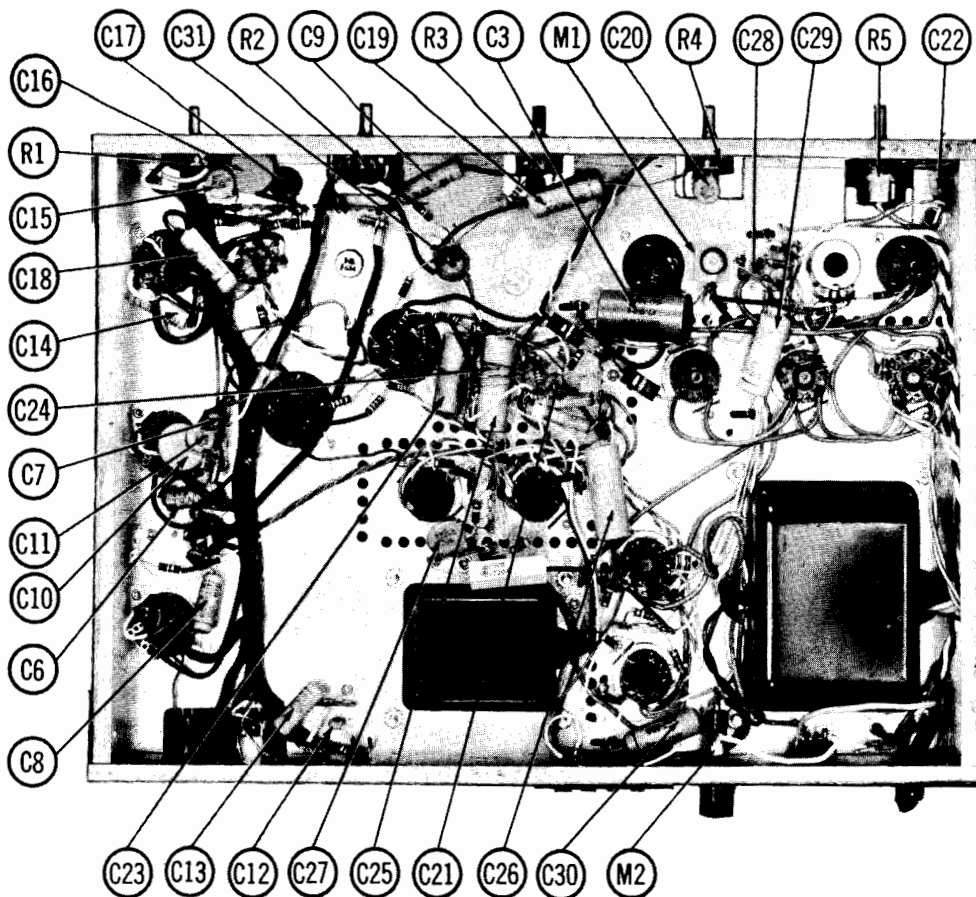
3. Turn the voltage regulator (R6) for a SLIGHT meter deflection. Measure the voltage at terminals 1, 2, 3, and 4 on the "CUR MON" strip. Keep the meter connected to that terminal which measures the highest voltage.

4. Turn the voltage regulator (R6) until the meter indicates .25 volt.

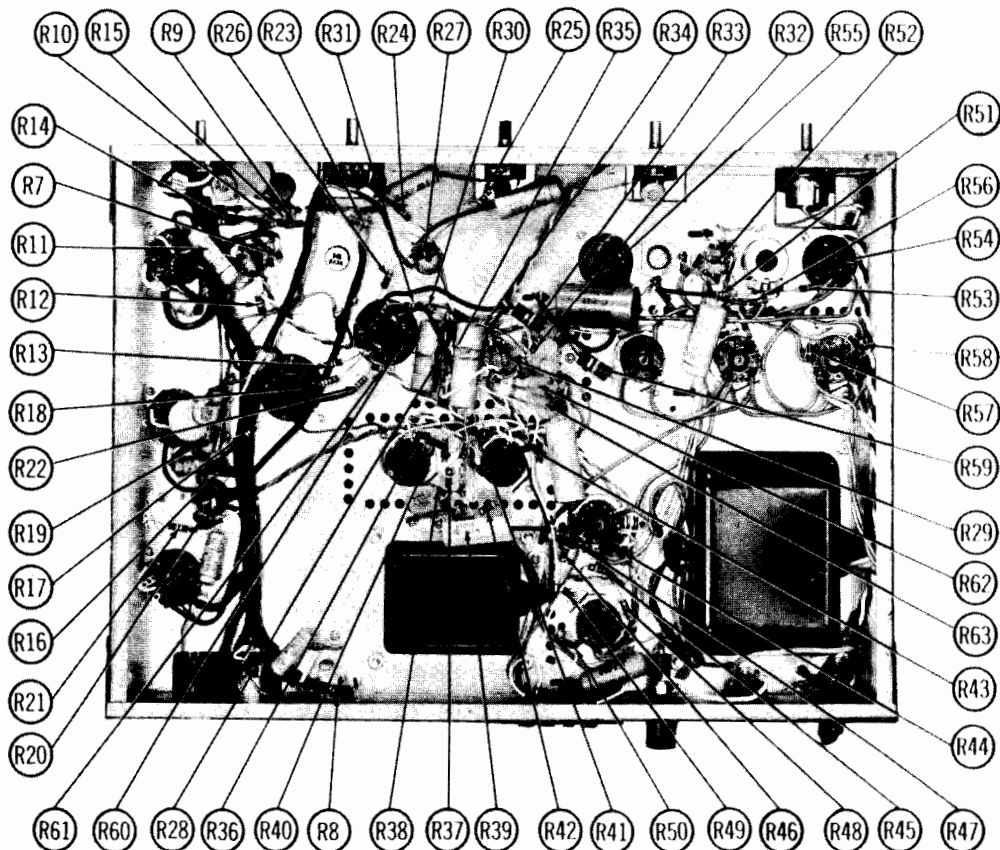
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CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

PARTS LIST AND DESCRIPTIONS TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE
V1	Mic 1-Tuner-Phono Preamp	12AX7 / ECC83
V2	Mic 2-Mic3 Preamp	12AX7 / ECC83
V3	AF Amplifier	6AV6
V4	AF Amp. -Phase Inv.	6U8
V5	Output	6AV5GA
V6	Output	6AV5GA

ELECTROLYTIC CAPACITORS

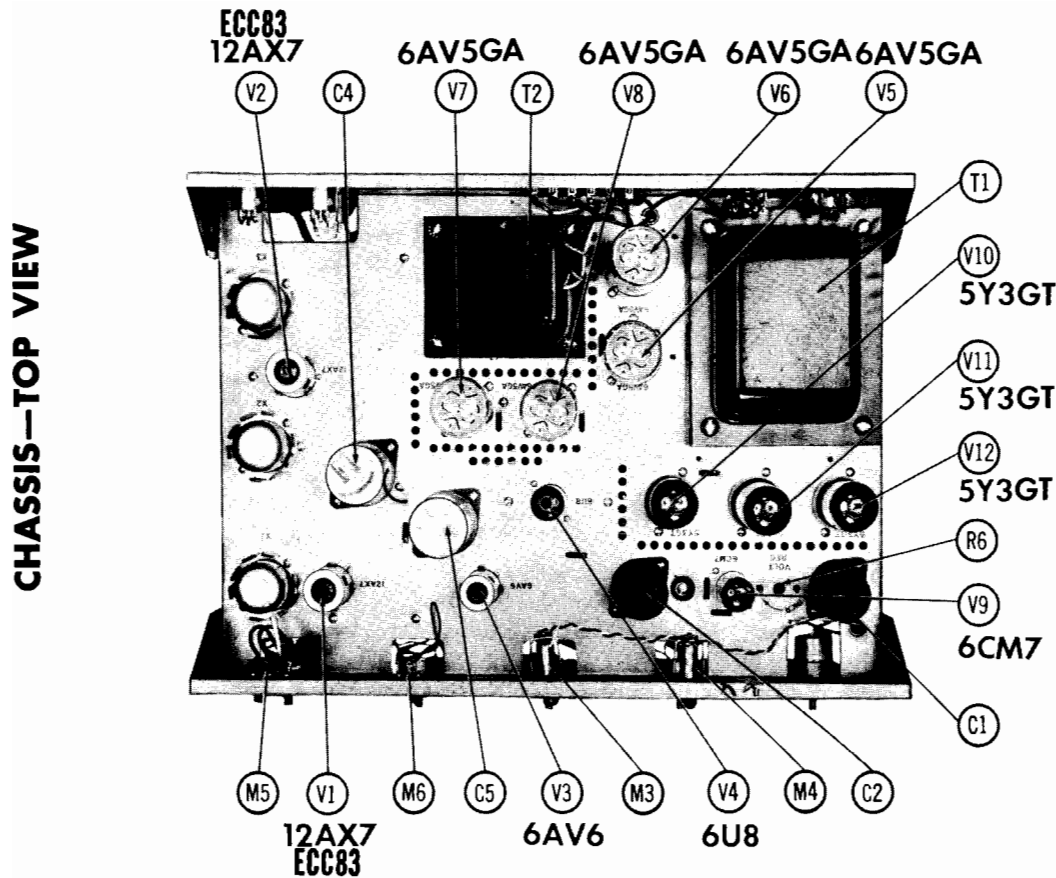
ITEM No.	RATING		REPLACEMENT DATA				
	CAP.	VOLT.	DAVID BOGEN PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.
C1	30	400		AFH1-51	A0470	FPI45	TVM-1720
C2	30	400		AFH1-51	A0470	FPI45	TVM-1720
C3	50	100		PRSI50V50	BR5015	TC49	TVA-1414
C4	5	200		AFH4-09	D0080	WP433.6	TVA-1414
C5	5	200					Q-027
C6	5	200					
C7	5	200					
C8	10	350		AFH4-19-10	D0179.3	FP474.5	Q-035
C9	10	350					MT-4510
C10	20	450					
C11	20	450					

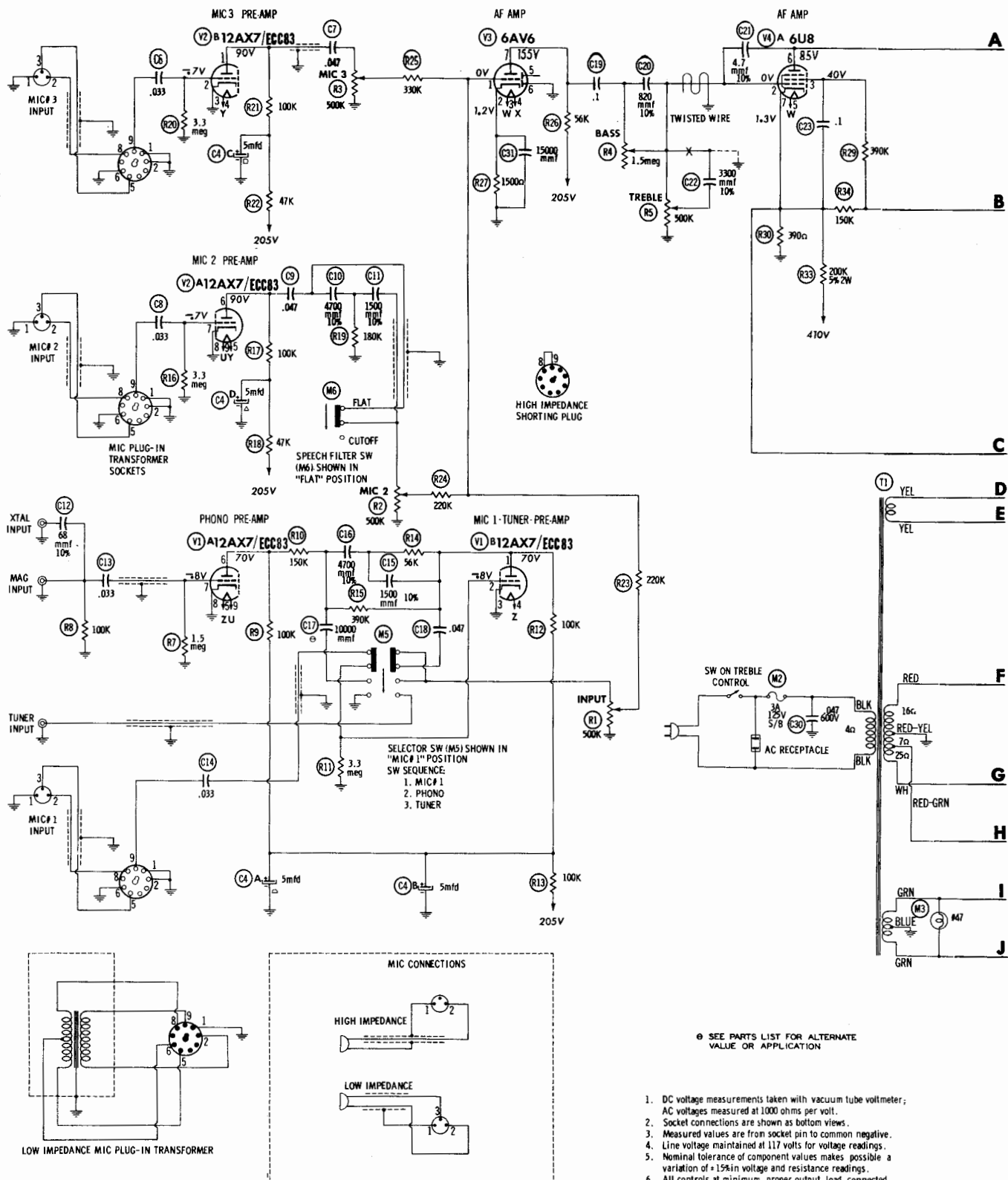
FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

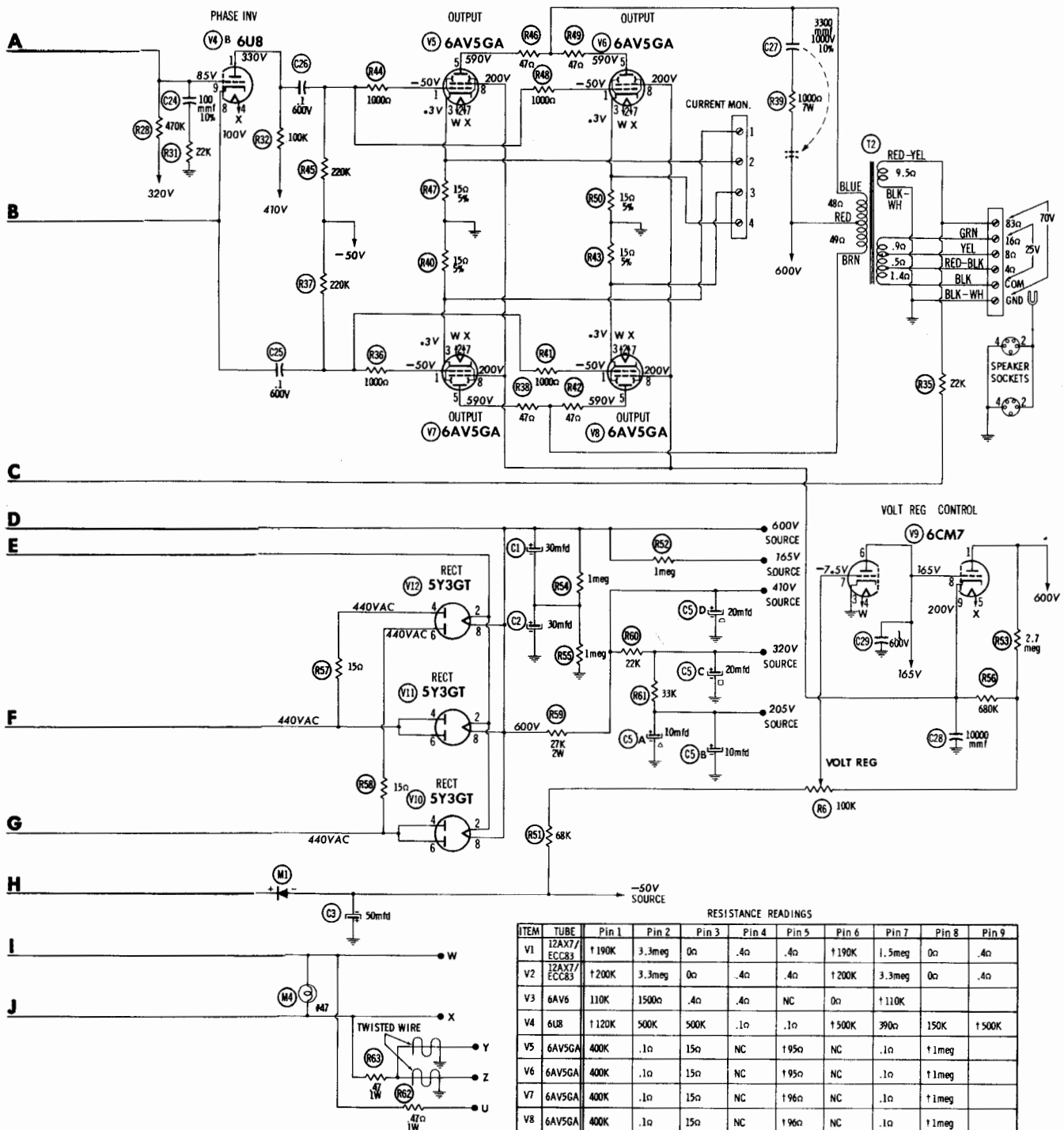
ITEM No.	RATING		DAVID BOGEN PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	REPLACEMENT DATA				NOTES
	CAP.	VOLT					ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.		
C6	.033	200		P288N-033	DF-303	CUB6S33		GEM-4133	6TM-533	10%	
C7	.047	200		P288N-047	DF-503	CUB2847		GEM-4147	2TM-547		
C8	.033	200		P288N-033	DF-303	CUB6S33		GEM-4133	6TM-533	10%	
C9	.047	200		P288N-047	DF-503	CUB2847		GEM-4147	2TM-547		
C10	4700					IRSD47	CY20C472K		MS-247	10%	
C11	1500					IRSD15	ED-1500		MS-215		
C12	.033	200		NFO-D168	DD-680	L10Q68	ED-68		MS-468	10%	
C13	.033	200		P288N-033	DF-303	CUB6S33		GEM-4133	6TM-533		
C14	.033	200		P288N-033	DF-303	CUB6S33		GEM-4133	6TM-533	10%	
C15	1500					IRSD15	ED-1500		MS-215		
C16	4700					IRSD47	CY20C472K		MS-247	10%	
C17	100000					IRSD15	ED-01	DC511	5HK-S1		
C18	.047	200		BPD-01	DD-103	BYA6S1		GEM-4147	2TM-547	10%	
C19	.047	200		P288N-1	DF-104	CUB2P1		GEM-201	2TM-P1		
C20	820			NFO-D14.7	TCZ-4R7	RS1T32	ED-820		MS-382	10%	
C21	4.7					C10V47C	TCU-4.7	ZT-5547	3TCCB-V47		
C22	3300					IRSD33	CY20C332K		MS-233	10%	
C23	.033	200		P288N-1	DF-104	CUB2P1		GEM-201	2TM-P1		
C24	100	600		NFO-D1000	DD-101	L10T1	ED-100	MCEB35	MS-31	10%	
C25	.1	600		P688N-1	DF-104	CUB6P1		GEM-401	6TM-P1		
C26	.1	600		P688N-1	DF-104	CUB6P1		GEM-401	6TM-P1	10%	
C27	3300	1000									
C28	327	10000		BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	10%	
C29	.033	600		P688N-1	DF-104	CUB6P1		GEM-401	6TM-P1		
C30	.047	600		P688N-047	DF-503	CUB6S47		GEM-6147	6TM-S47	10%	
C31	150000			BPD-015	DD16-153	BYA10S15	ED-015		5HK-S15		

① Some version many use 15000mfd in this application.





A PHOTOFAC STANDARD NOTATION SCHEMATIC
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RESISTANCE READINGS										
ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7/ ECC83	†190K	3.3meg	0a	.4a	.4a	†190K	1.5meg	0a	.4a
V2	12AX7/ ECC83	†200K	3.3meg	0a	.4a	.4a	†200K	3.3meg	0a	.4a
V3	6AV6	110K	1500a	.4a	.4a	NC	0a	†110K		
V4	6U8	†120K	500K	500K	.1a	.1a	†500K	390a	150K	†500K
V5	6AV5GA	400K	.1a	15a	NC	†95a	NC	.1a	†1meg	
V6	6AV5GA	400K	.1a	15a	NC	†95a	NC	.1a	†1meg	
V7	6AV5GA	400K	.1a	15a	NC	†96a	NC	.1a	†1meg	
V8	6AV5GA	400K	.1a	15a	NC	†96a	NC	.1a	†1meg	
V9	6CM7	†1a	NC	0a	.1a	.1a	†1meg	320K	†1meg	1meg
V10	5Y3GT	NC	20K(min)	NC	16a	NC	16a	NC	20K(min)	
V11	5Y3GT	NC	20K(min)	NC	32a	NC	32a	NC	20K(min)	
V12	5Y3GT	NC	20K(min)	TP	40a	NC	40a	TP	20K(min)	

† MEASURED FROM PIN 2 OF V12
 NC NO CONNECTION
 TP TIE POINT

PARTS LIST AND DESCRIPTIONS (Continued)

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA				INSTALLATION NOTES
	RESISTANCE	WATTS	DAVID BOGEN PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	
R1A	500K	$\frac{1}{2}$	V367	B-60	A47-500K-Z	Q13-133	Input
R1B	500K	$\frac{1}{2}$	V367	B-60	A47-500K-Z	Q13-133	Mic 2
R2A	500K	$\frac{1}{2}$	V367	B-60	A47-500K-Z	Q13-133	Mic 3
R2B	500K	$\frac{1}{2}$	V367	B-60	A47-500K-Z	Q13-133	Bass
R3A	500K	$\frac{1}{2}$	V367	B-60	A47-500K-Z	Q13-133	Treble
R3B	500K	$\frac{1}{2}$	V367	B-60	A47-500K-Z	Q13-133	Volt Regulator
R4A	1.5meg	$\frac{1}{2}$	V407	B-76	A47-2meg-Z	Q13-139	
R4B	500K	$\frac{1}{2}$	V377	B-60	A47-500K-Z	Q13-133	
R5A	500K	$\frac{1}{2}$	V377	B-60	A47-500K-Z	Q13-133	
R5B	500K	$\frac{1}{2}$	V377	B-60	A47-500K-Z	Q13-133	
R6A	100K	$\frac{1}{2}$	V392	KB-1	SWE-12	76-1	
R6B	100K	$\frac{1}{2}$	V392	KB-1	A47-100K-S*	TA15L	
R7A	100K	$\frac{1}{2}$	V392	KB-1	FKS-1/4	TM-Kit	

* Enlarge Mounting Hole to 3/8"

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	DAVID BOGEN PART No.	DAVID BOGEN PART No.	
R7	1.5meg				
R8	100K				
R9	100K				
R10	100K				
R11	150K				
R12	100K				
R13	100K				
R14	50K				
R15	390K				
R16	100K				
R17	100K				
R18	47K				
R19	180K				
R20	100K				
R21	100K				
R22	47K				
R23	220K				
R24	220K				
R25	330K				
R26	58K				
R27	1500Ω				
R28	470K				
R29	390K				
R30	390Ω				
R31	22K				
R32	100K				
R33	200K 5%	2			
R34	150K				
R35	22K				

PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA			
	PRI.	SEC. 1	SEC. 2	SEC. 3	DAVID BOGEN PART No.	Merit PART No.	Slancor PART No.	Thorderson PART No.
T1	117V ③ 1.1A	870VCT ③ .052A 3TV ④ 1.001A	5V ③ 6A	6.3VCT ③ 7A	T3150			

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	REPLACEMENT DATA				REPLACEMENT DATA			
	IMPEDANCE	DAVID BOGEN PART No.	Merit PART No.	Slancor PART No.	Thorderson PART No.	Merit PART No.	Slancor PART No.	Thorderson PART No.
T2	3300Ω CT	70V SEC.1 (83Ω) Tap ④ 160 80, 40	T3124					

RECTIFIER

ITEM No.	RATING CURRENT (Measured)	REPLACEMENT DATA				NOTES
		DAVID BOGEN PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	SARKES TARZIAN PART No.	
M1	.001A	H373	1263A	BS065	10	

FUSE

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			DAVID BOGEN PART No.		LITTELFUSE PART No.		BUSS PART No.	
M2	3AG	3A 125V S/ B	FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
					313003 (3AG 3A 125V S/ B)	342001	MDX3	HKP

MISCELLANEOUS

ITEM No.	PART NAME		DAVID BOGEN PART No.	NOTES
M3	Pilot Lamp		447	
M4	Pilot Lamp		447	
M5	Switch	S475		
M6	Switch	S361		

WIRING DATA

General-use Unshielded Hook-up Wire Use BELDEN No. 8530 (Solid) Available in Ten Colors				
Power Cord Use BELDEN No. 8524 (Stranded) Available in Ten Colors				
Low-Loss Shielded Lead (Interconnecting) Use BELDEN No. 1768-B (6 Ft. Length)				
Phono Pick-up Arm Cable Use BELDEN No. 1725-K (1½ Ft. Length)				
..... Use BELDEN No. 8430 (Two Conductor - Twisted)				



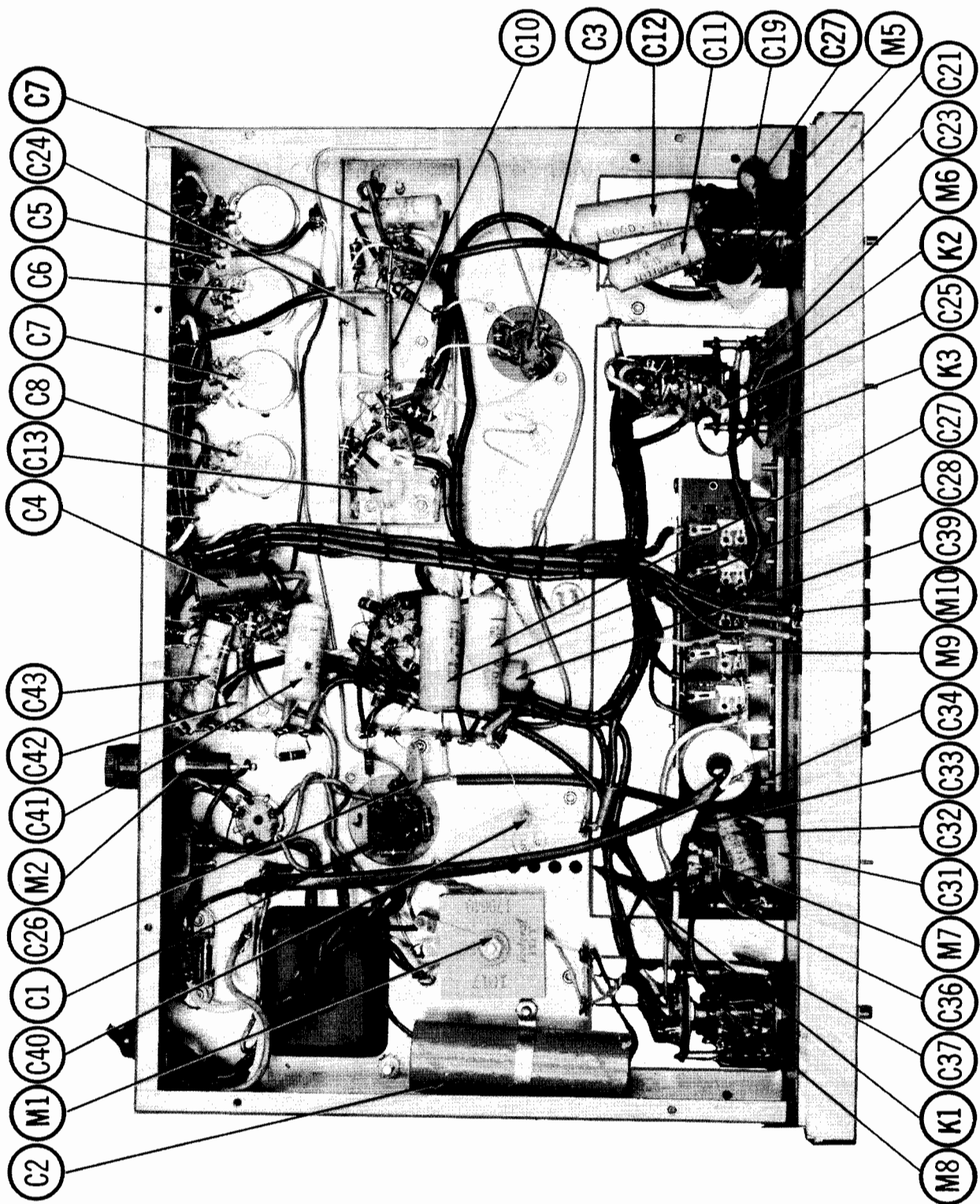
DAVID BOGEN
MODEL PR100A

TRADE NAME	David Bogen Model PR100A		
MANUFACTURER	David Bogen Co., Inc., P. O. Box 500, Paramus, N. J.		
TYPE SET	AC Operated 8 Channel Equalizer Preamplifier		
TUBES (Five)	Types 12AU7/ECC82 Phono Preamplifier, 12AX7/ECC83 Phono AF Amplifier, 12AT7/ECC81 AF Amplifier, 12AU7/ECC82 AF Amp. - Cath. Follower, 6X4 Rectifier		
POWER SUPPLY	110-120 Volts AC-60 Cycles	RATING	.23 Amp. @ 117 Volts AC (23 Watts)

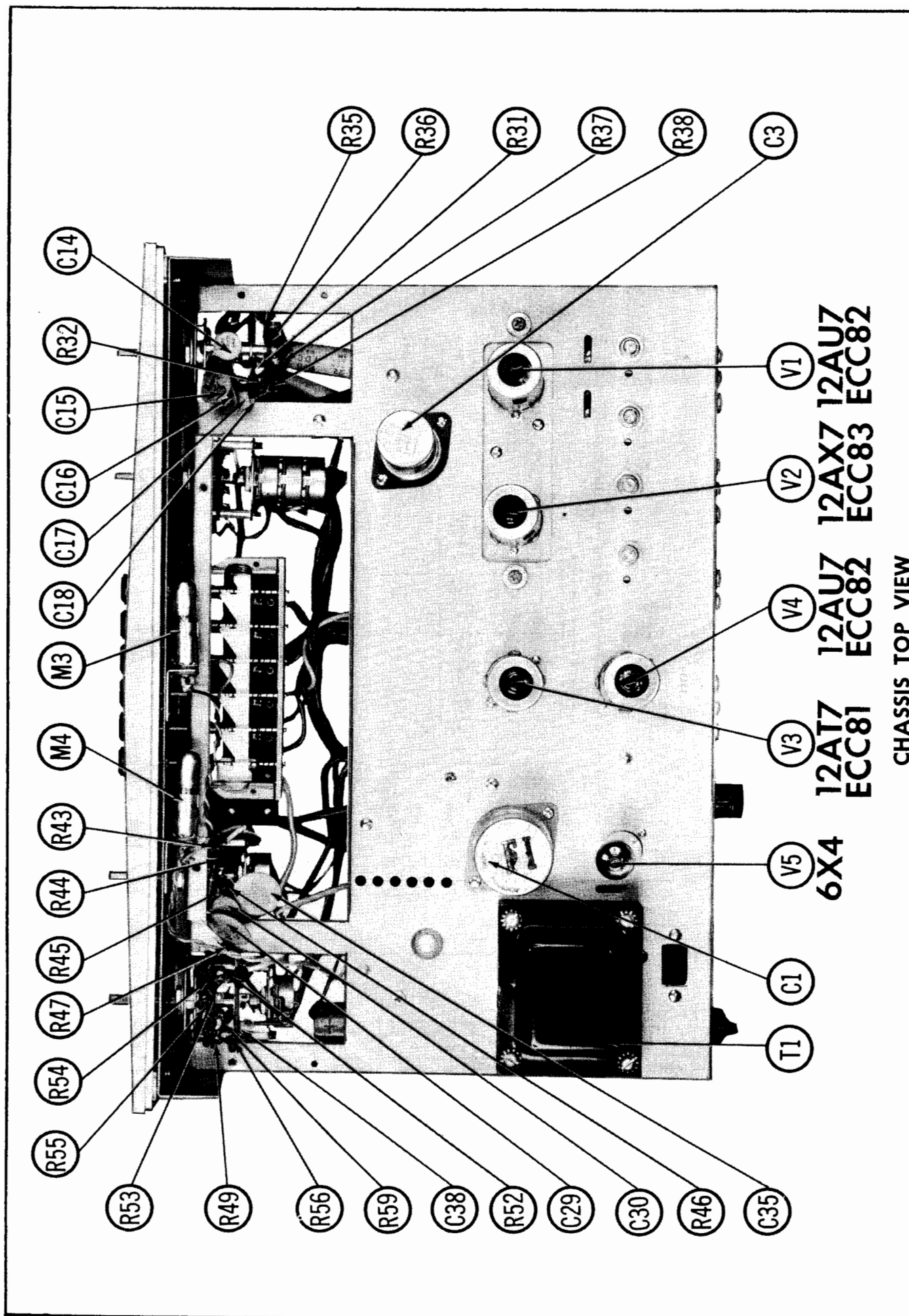
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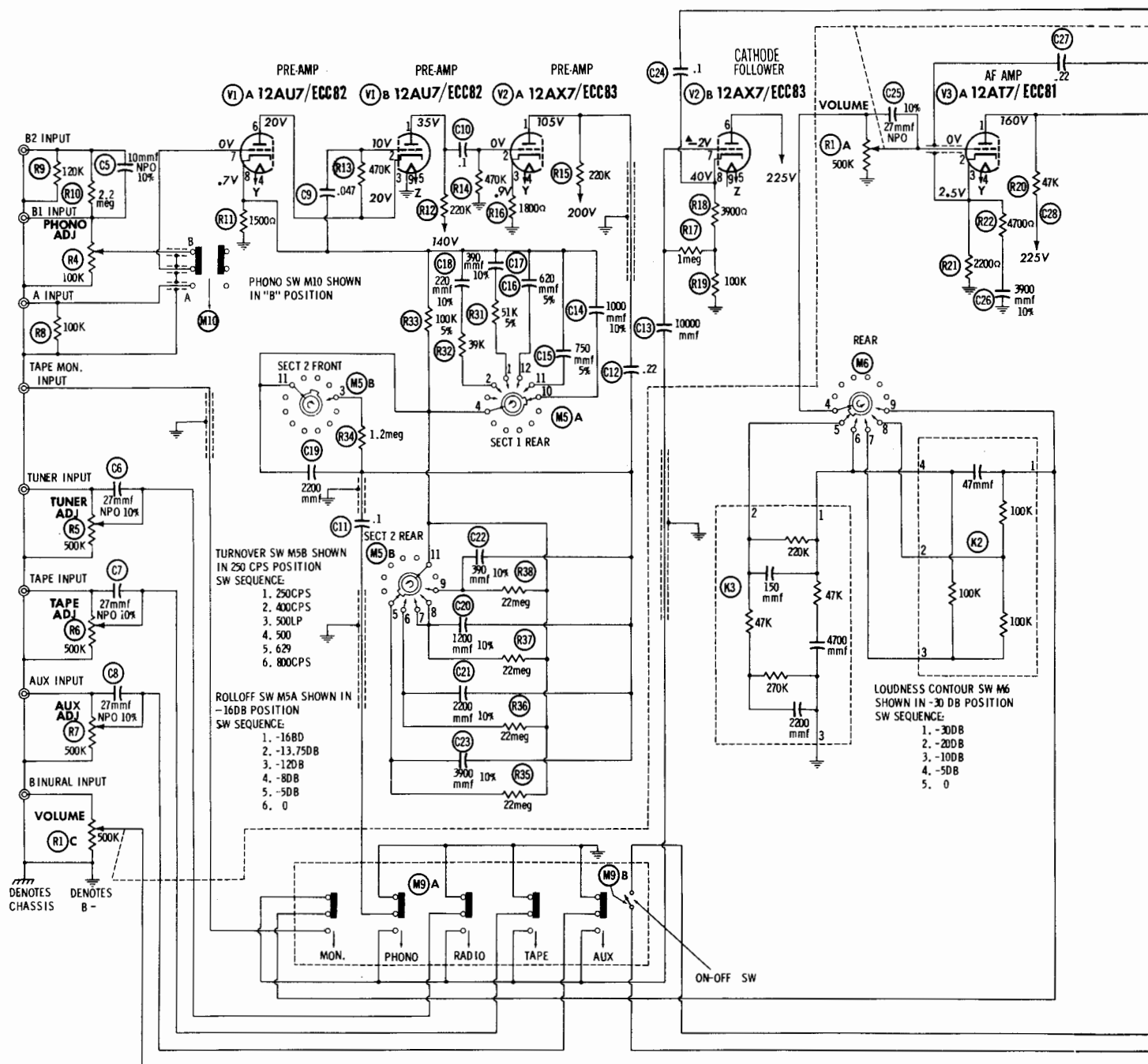
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CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION





1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of $\pm 15\%$ in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AU7/ECC82	↑ 370K	INF	INF	6Ω	6Ω	INF	100K	1500Ω	0Ω
V2	12AX7/ECC83	↑ 250K	470K	1800Ω	6Ω	6Ω	↑ 30K	1.1Meg	100K	9Ω
V3	12AT7/ECC81	↑ 77K	0Ω	2200Ω	6Ω	6Ω	↑ 130K	2.2Meg	1000Ω	9Ω
V4	12AU7/ECC82	↑ 120K	600K	1000Ω	6Ω	6Ω	↑ 20K	1.1Meg	115K	9Ω
V5	6X4	1000Ω	NC	0Ω	.3Ω	NC	1000Ω	20K(4M)		

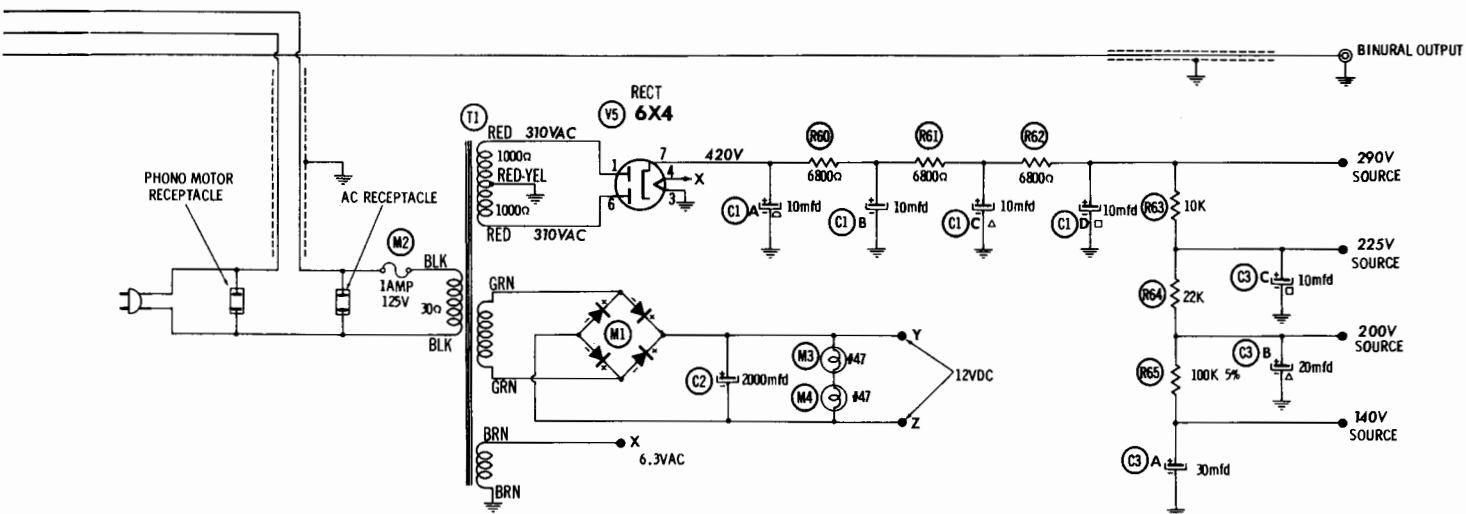
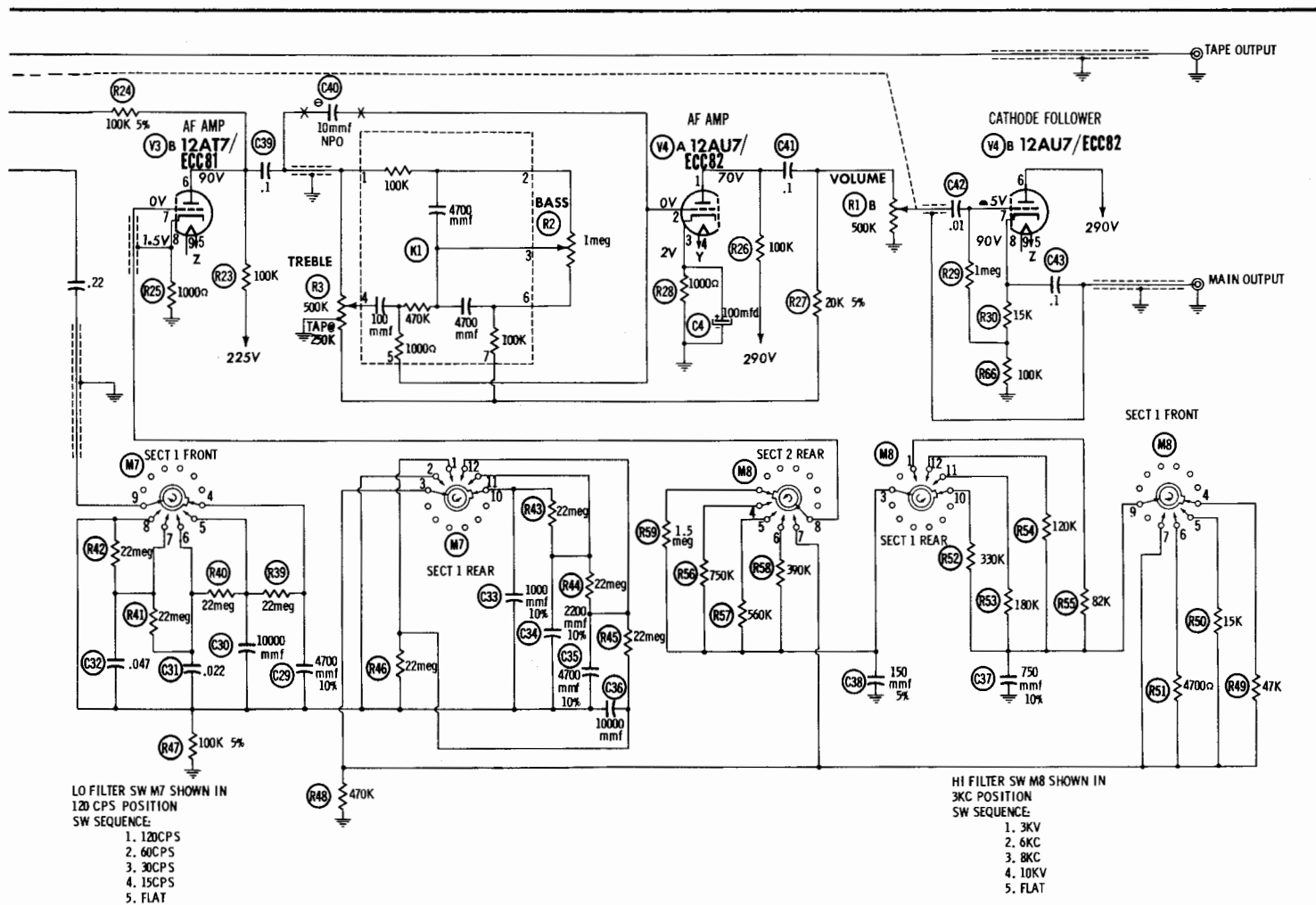
ALL MEASUREMENTS TAKEN IN "AUX" POSITION

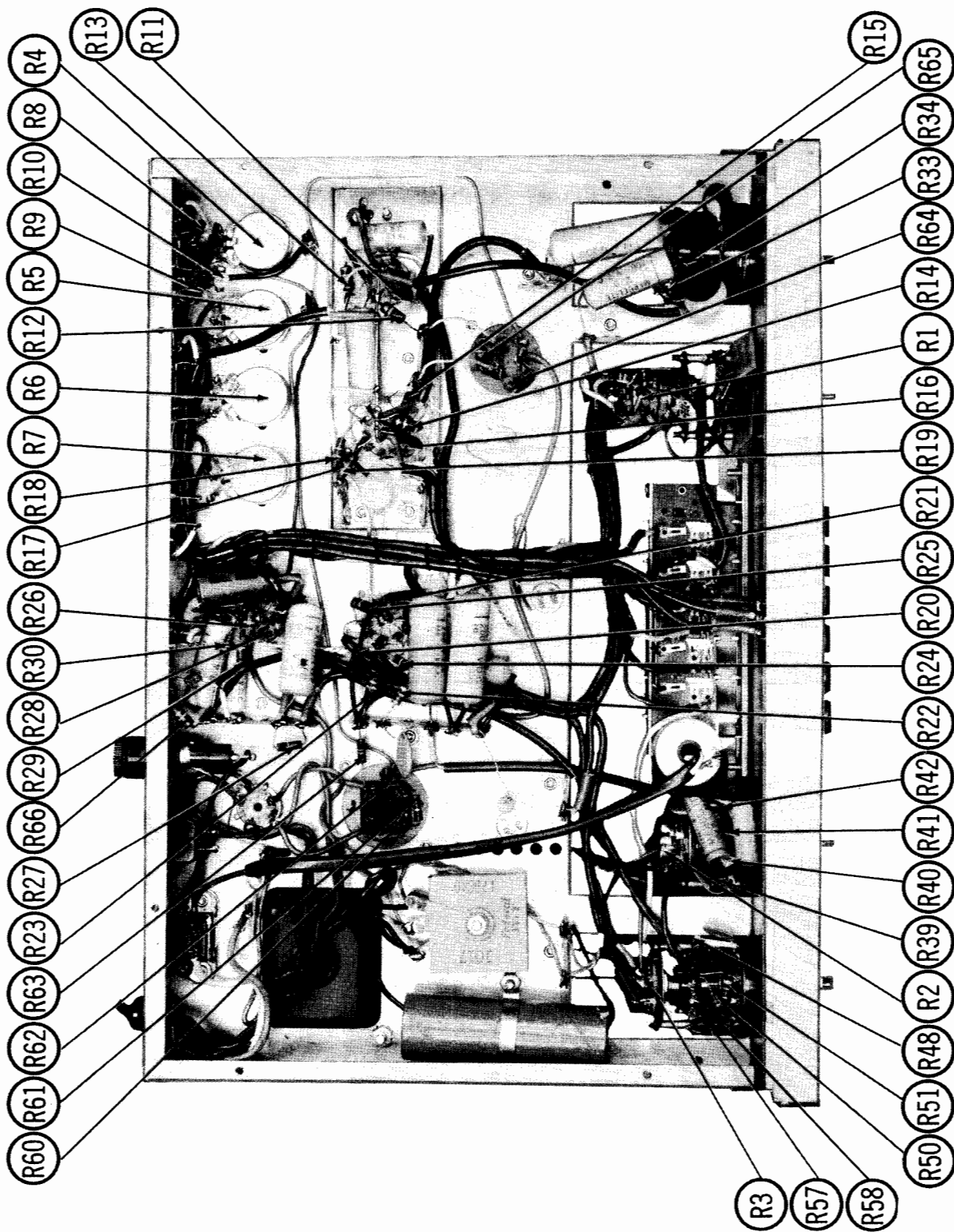
↑ MEASURED FROM PIN 8 OF V4

↑ MEASURED FROM PIN 8 OF V2

↑ MEASURED FROM PIN 7 OF V5

NC NO CONNECTION





CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	ITEM No.	USE	TYPE
V1	Phono Preamplifier	12AU7/ECC82	V4	AF Amp. - Cath. Follower	12AU7/ECC82
V2	Phono AF Amplifier	12AX7/ECC83	V5	Rectifier	6X4
V3	AF Amplifier	12AT7/ECC81			

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA		SPRAGUE PART No.
	CAP.	VOLT.	CORNEILL DUBIER PART No.	MALLORY PART No.	
C1A	10	450	D0900	FM434	TMQ-10
C1B	10	450			Q-030
C1C	10	450			Q-030
C2	2000	15	BR20001	TC1501	TD-1000-15
C3A	30	150		FP330.3	TD-1000-15
C3B	40	200		TC47	D335
C3C	100	250			MT-1530
C4	100	15	PRSRV100	TC2501	TD-100-6
					MTH-0810
					TVA-1101

* NON CATALOG ITEM

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	CAP.	VOLT.	CORNEILL DUBIER PART No.	MALLORY PART No.	
C5	10		TCZ-10	TCO-10	5TCC-Q1
C6	27		TCZ-27	TCO-27	NP0 10%
C7	27		TCZ-27	TCO-27	NP0 10%
C8	27		TCZ-27	TCO-27	NP0 10%
C9	.047	200	DF-503	GEM-4147	2TM-S47
C10	.1	200	DF-104	GEM-201	2TM-P1
C11	.1	200	DF-104	GEM-201	2TM-P1
C12	.22	200	DD-103	CUB2P22	2TM-P22
C13	10000		DD-103	DC511	5HK-SI
C14	1000			ED-1000	10%
C15	750			ED-1000	5%
C16	620			ED-390	5%
C17	390		D8-391	ED-220	10%
C18	220		D8-221	ED-0022	10%
C19	2200		DD-222	BYA10D22	5GA-D22
C20	1200			ED-1200	10%
C21	2200			ED-390	10%
C22	390		D8-391	ED-390	10%
C23	3900		DF-104	CUB2P1	10%
C24	.1	200	TCZ-27	CUB2P27	10%
C25	.1	200	TCZ-27	CUB2P27	10%
C26	3900		DD-103	BYA6S1	ED-01
C27	.22	200	DD-103	ED-02	5HK-SI
C28	.22	200	DD-103	ED-02	5HK-SI
C29	4700		DD-103	ED-1000	10%
C30	10000			ED-1000	10%
C31	.022	200	DD-203	CUB4S22	2TM-S22
C32	.047	200	DF-503	CUB2S47	2TM-S47
C33	1000				10%
C34	2200				10%
C35	4700				10%
C36	10000				10%
C37	750		DD-103	BYA6S1	5HK-SI
C38	150		TCZ-150	TCO-150	5TCC-T15
C39	.1	200	DF-104	CUB2P1	2TM-P1
C40	10		TCZ-10	CUB2P1	2TM-P1
C41	.1	400	DF-104	CUB4P1	4TM-P1
C42	.01	200	DD-103	CUB4S1	4TM-S1
C43	.1	200	DF-104	CUB2P1	2TM-P1

① Not used in some versions.

PARTS LIST AND DESCRIPTIONS (Continued)

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA		INSTALLATION NOTES
	RESISTANCE	WATTS	DAVID BOGEN PART No.	MALLORY PART No.	
R1A	500K		S452B	Q13-133	Volume
R1B	500K			Q13-133	Volume
R2A	1Meg			Q13-133	Volume
R2B	500K			Q13-133	Volume
R3A	500K			Q13-133	Volume
R3B	500K			Q13-133	Volume
R4A	100K			Q13-133	Volume
R4B	500K			Q13-133	Volume
R5A	500K			Q13-133	Volume
R5B	500K			Q13-133	Volume
R6A	500K			Q13-133	Volume
R7A	500K			Q13-133	Volume

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		NOTES	ITEM No.	RATING		NOTES
	OHMS	WATT			OHMS	WATT	
R8	100K			R38	22Meg		
R9	120K			R39	22Meg		
R10	2.2Meg			R40	22Meg		
R11	1500Ω			R41	22Meg		
R12	220K			R42	22Meg		
R13	470K			R43	22Meg		
R14	470K			R44	22Meg		
R15	220K			R45	22Meg		
R16	1800Ω			R46	22Meg		
R17	1Meg			R47	100K 5%		
R18	3900Ω			R48	47K		
R19	100K			R49	47K		
R20	47K			R50	15K		
R21	2200Ω			R51	4700Ω		
R22	4700Ω			R52	330K		
R23	100K			R53	180K		
R24	100K 5%			R54	120K		
R25	1000Ω			R55	82K		
R26	100K			R56	750K		
R27	20K 5%			R57	560K		
R28	1000Ω			R58	390K		
R29	1Meg			R59	1.5Meg		
R30	15K			R60	6800Ω		
R31	51K 5%			R61	6800Ω		
R32	39K			R62	6800Ω		
R33	100K 5%			R63	10K		
R34	1.2Meg			R64	22K		
R35	22Meg			R65	100K 5%		
R36	22Meg			R66	100K		
R37	22Meg						

TRANSFORMER (POWER)

ITEM No.	RATING			REPLACEMENT DATA		
	PR1	SEC. 1	SEC. 2	DAVID BOGEN PART No.	MALLORY PART No.	THORNTON PART No.
T1	117VAC	640VCT	6.3VAC	T3133-1		
	② .23A	② .008A	② .6A			

PARTS LIST AND DESCRIPTIONS (Continued)

COMPONENT COMBINATIONS

ITEM No.	USE	DESCRIPTION	David Bogen PART No.	REPLACEMENT DATA
K1	Tone Compensation	4700MMF, 4700MMF, 100MMF 100K, 470K, 10000, 100K	C392	Centralab PC190
K2	Tone Compensation	47MMF, 100K, 100K, 100K	C419	Sprague 104C-II
K3	Tone Compensation	150MMF, 4700MMF, 2200MMF 47K, 47K, 270K, 220K	C420	Sprague 102C-22

SELENIUM RECTIFIER

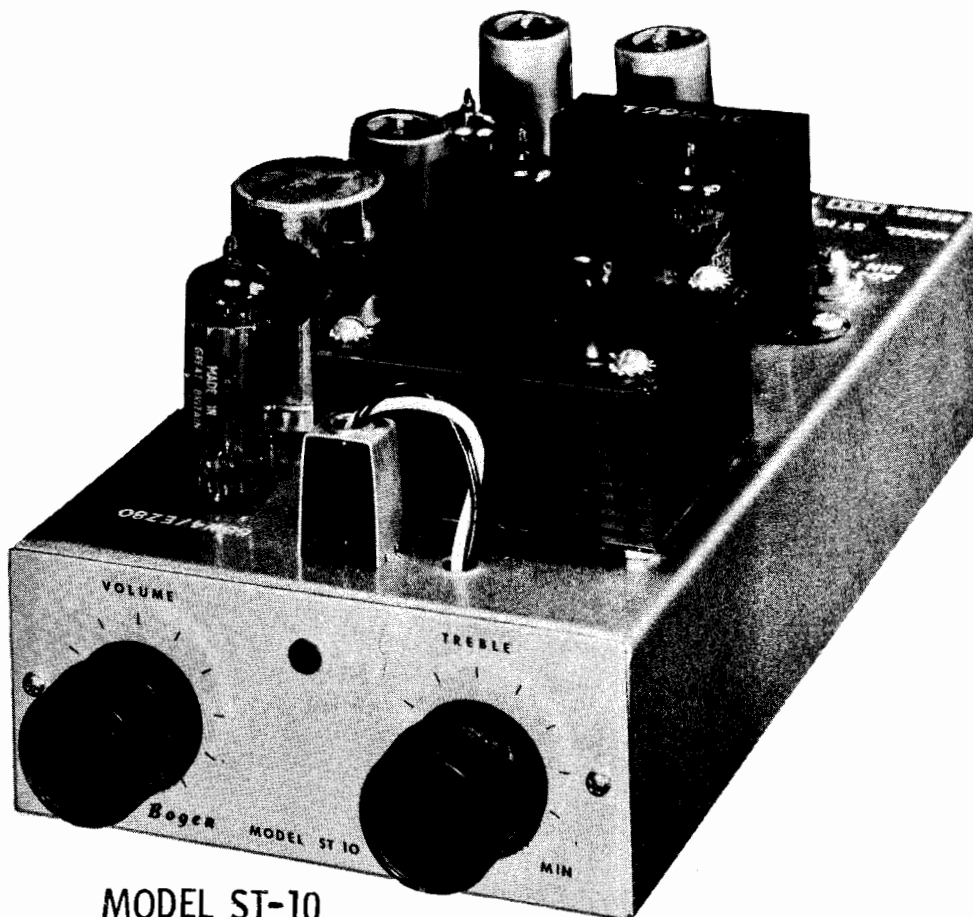
ITEM No.	RATING CURRENT (Measured)	REPLACEMENT DATA			NOTES
		David Bogen PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	
M1	.720A	H-432	1017	C1B	604B

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA			
			David Bogen PART No.	UTTELFUSE PART No.	FUSE	BUSS PART No.
M2	3AG	1A 125V Slo-Blo			31300L (3AG 1A 125V S/B)	MDLI HKP

MISCELLANEOUS

ITEM No.	PART NAME	David Bogen PART No.	NOTES
M3	Pilot Lamp		#47
M4	Pilot Lamp		#47
M5A	Switch	S422A	Roll-off (Rotary Wafer Type)
M5B	Switch	S422A	Turnover (Rotary Wafer Type)
M6	Switch	S452A	Contour (Rotary Wafer Type)
M7	Switch	S424C	Lo Filter (Rotary Wafer Type)
M8	Switch	S425C	Hi Filter (Rotary Wafer Type)
M9A	Switch	S426E	Input Selector Assy (Pushbutton Slide Type)
M9B	Switch		On-Off (Pushbutton Slide Type)
M10	Switch	S476	Phono (A & B) (Slide Type SPST)



MODEL ST-10

DAVID BOGEN
MODELS ST-10, ST-10G

TRADE NAME	David Bogen Models ST-10, ST-10G		
MANUFACTURER	David Bogen Co., Inc., P. O. Box 500, Paramus, N. J.		
TYPE SET	AC Operated Audio Amplifier		
TUBES (Seven)	Types ECC83/12AX7 (or) 12AD7 Ch. 2 Preamplifier, 6C4 Ch. 2 Cathode Follower, ECC83/12AX7 (or) 12AD7 Ch. 1 Preamplifier, 6U8 Ch. 1 AF Amp. - Phase Inv., (2) 6AQ5 Ch. 1 Output, EZ80/6V4 (or) EZ81/6BW4 Rectifier		
POWER SUPPLY	110-120 Volts AC-60 Cycles	RATING	.52 Amp. @ 117 Volts AC (52 Watts)

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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PARTS LIST AND DESCRIPTIONS TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Ch. 2 Preamp/ifier	ECC83/ 12AX7	Note 1
V2	Ch. 2 Cathode Follower	6C4	Note 1
V3	Ch. 1 Preamp/ifier	ECC83/ 12AX7	Note 1
V4	Ch. 1 AF Amp. - Phase Inv.	6U8	
V5	Ch. 1 Output	6AQ5	
V6	Ch. 1 Output	6AQ5	
V7	Rectifier	EZ80/ 6BW4	Note 2

Note 1. Type 12AD7 may be used in some versions.

Note 2. Type EZ80/6BW4 may be used in some versions.

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA			
	CAP.	VOLT.	DAVID BOGEN PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.
C1A	.30	350		ATF4-48	CD0080	
C1B	.5	350			BR3035	
C1C	4.5	350				
C1D	10	25				
C2	8	250	①	PRS250V8	BBR8-250	TC51
						TD-8-250
						MT-2508
						TVA-1503

① Some versions may use 20MFD in this application.

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA				NOTES
	CAP.	VOLT.	DAVID BOGEN PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	
C3	.02	200		P288N-022	DD-203	CUB4822	
C4	.02	200		P288N-022	DD-203	CUB4822	
C5	.02	200		BPD-00027	DD-271	LI0727	
C6	.03	200		P288N-033	DF-303	CUB6533	
C7	.1	200		P288N-1	DF-104	CUB221	
C8	.02	200		P288N-022	DD-203	CUB4822	
C9	.02	200		P288N-022	DD-203	CUB4822	
C10	.02	200		BPD-00027	DD-271	LI0727	
C11	.03	200		P288N-033	DF-303	CUB6533	
C12	.0022	200		P288N-0022	D8-222	CUB6122	
C13	.03	200		P288N-033	DF-303	CUB6533	
C14	.02	400		P488N-022	DD-203	CUB4822	
C15	.02	400		P488N-022	DD-203	CUB4822	
C16	.02	400		P488N-022	DD-203	CUB4822	
C17	.02	400		P488N-022	DD-203	CUB4822	
C18	.02	400		P488N-022	DD-203	CUB4822	
C19	.02	400		P488N-022	DD-203	CUB4822	

① Some versions may use .033MFD in this application.

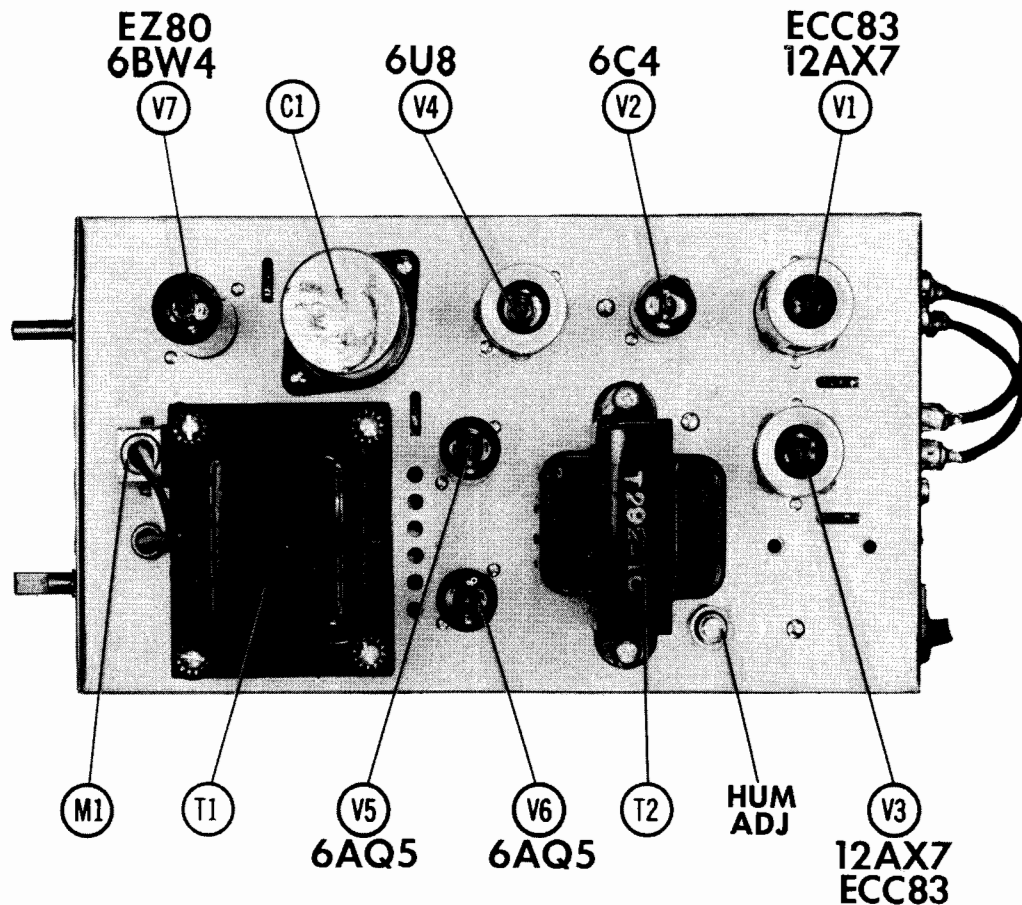
② Some versions may use 270MMF in this application.

③ Not used in some versions.

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA				INSTALLATION NOTES
	RESIST-ANCE	WATTS	DAVID BOGEN PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	
R1A	500K		V411A	BB-104	AD47-500K-2	Q13-133	Volume
R1B	500K			Not Req.	Not Req.	MI3-133	Volume
R2A	500K		V323A	Not Req.	FS-3	Not Req.	Treble
R2B	500K			Not Req.	FS-3	Not Req.	
R2C	500K			Not Req.	FS-3	Not Req.	
R2D	500K			Not Req.	FS-3	Not Req.	
R3A	500K		V113A	KB-5	SWE-12	76-1	Hum Balance (Wire Wound)
R3B	500K			WN-500	A43-50	WPK50	
R3C	500K			FXB-1/4	FXB-1/4	R50L	
R3D	500K			Not Req.	Not Req.	Not Req.	

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued) **RESISTORS**

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	David Bogen PART No.	IRC PART No.	
R4	100K			BTS-100K	
R5	3.3Meg			BTS-3.3Meg	
R6	220K			BTS-220K	
R7	100K			BTS-100K	
R8	3.3Meg			BTS-3.3Meg	
R9	220K			BTS-220K	
R10	47K			BTS-47K	
R11	100K			BTS-100K	
R12	3.3Meg			BTS-3.3Meg	
R13	220K			BTS-220K	
R14	100K			BTS-100K	
R15	3.3Meg			BTS-3.3Meg	
R16	220K			BTS-220K	
R17	150K			BTS-150K	
R18	47K			BTS-47K	
R19	470K			BTS-470K	
R20	100K			BTS-100K	
R21	390K			BTS-390K	
R22	100K			BTS-100K	
R23	680Ω			BTS-680Ω	
R24	150K			BTS-150K	
R25	22K			BTS-22K	
R26	10K 5%			BTS-10K 5%	
R27	22K			BTS-22K	
R28	680K			BTS-680K	
R29	1200Ω			BTS-1200Ω	
R30	300Ω			BTS-300Ω	
R31	680K			BTS-680K	
R32	2200Ω			BTS-2200Ω	
R33	470			BTS-470	
R34	470 5%			BTS-470 5%	
R35	270 5%			BTS-270 5%	
R36	270 5%			BTS-270 5%	

Note 1. Some versions may use 100K in this application.
 Note 2. Some versions may use 22K in this application.
 Note 3. Some versions may use 100K in this application.
 Note 4. Some versions may use 33K in this application.
 Note 5. Some versions may use 82K in this application.
 Note 6. Not used in some versions.

TRANSFORMER (POWER)

ITEM No.	RATING		REPLACEMENT DATA	
	PRI.	SEC.	David Bogen PART No.	Thorderson PART No.
T1	117VAC ① .52A	6.3VAC ② .068A ③ 2.9A	T3174 ①	22R02 ② R-5B

① Alternate Part #T3159
 ② Tape 5V@ 2A winding and center tap on 6.3V winding.

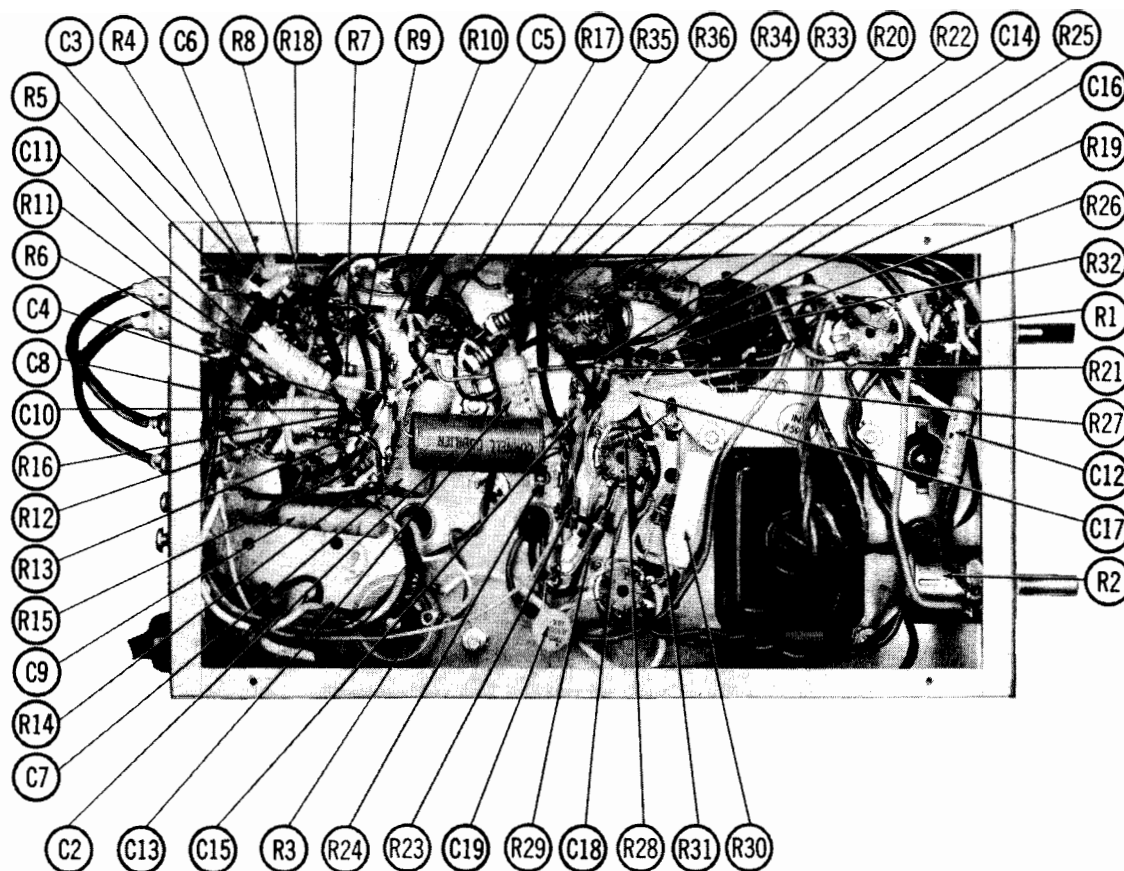
TRANSFORMER (AUDIO OUTPUT)

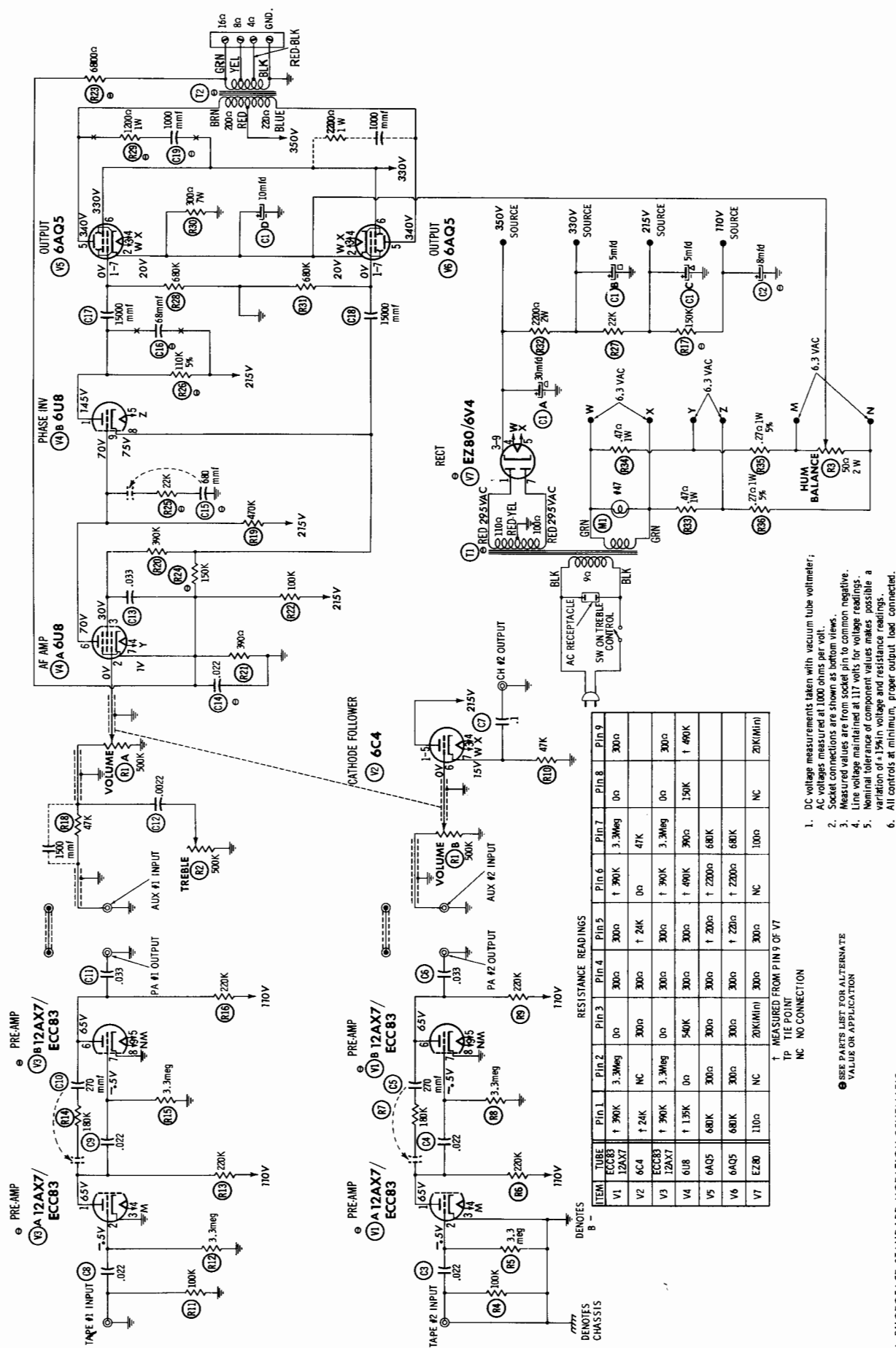
ITEM No.	IMPEDANCE		REPLACEMENT DATA		NOTES
	PRI.	SEC.	David Bogen PART No.	Thorderson PART No.	
T2	780Ω CT	16Ω Tap@ 82, 4Ω	T282-1 21112	Merit PART No. A-3027	① Alternate Part Number ② Drill new mounting hole
	360Ω CT	16Ω Tap@ 82, 4Ω	T282-3 21404 ②	26S59	

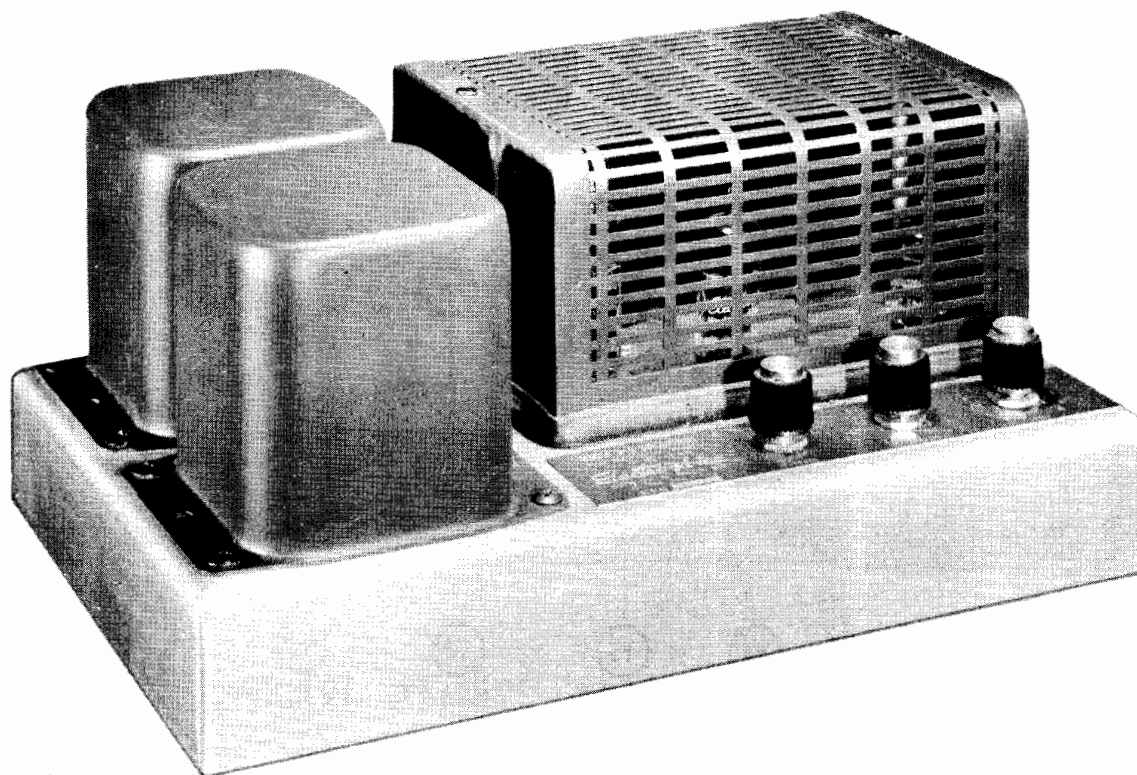
MISCELLANEOUS

ITEM No.	PART NAME	David Bogen PART No.	NOTES
M1	Pinch Light		#47

CHASSIS—BOTTOM VIEW







**ELECTRO-VOICE
MODEL A15**

TRADE NAME	Electro-Voice Model A15	
MANUFACTURER	Electro-Voice, Inc., Buchanan, Mich.	
TYPE SET	AC Operated Amplifier	
TUBES (Six)	Types 12AX7 AF Amp.-Phase Inv., 12BH7A Driver, (2) 6X4 Output, (2) 6X4 Rectifier	
POWER SUPPLY	105-125 Volts AC-60 Cycles	RATING .48 Amp. @ 117 Volts AC

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PARTS LIST AND DESCRIPTIONS TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	AF Amp.-Phase Inv.	12AX7	
V2	Driver	12BH7A	
V3	Output	EL84	
V4	Output	EL84	
V5	Rectifier	6X4	
V6	Rectifier	6X4	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA			
	CAP.	VOLT.	ELECTRO-VOICE PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.
C1A	.40	400	4208	AFR2-57	B0450	FP238
C1B	.40	400				
C2A	.40	400	4208	AFR2-57	B0450	FP238
C2B	.40	400				
C3	20	400	4207	AFR1-45	A0460	FP144
C4	50	100	4242	PRB150V50	BR5015	TC49

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA			
	CAP.	VOLT.	ELECTRO-VOICE PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.
C5	.1	200	4285	P288N-1	DF-104	CUB22P1
C6	100	4281	4281	BPD-001	DD-101	G042
C7	.022	400	4280	BPD-02	DD-203	CUB4822
C8	.047	400	4243	BPD-05	DF-503	CUB4847
C9	.047	400	4243	BPD-05	DF-503	CUB4847
C10	10000	4257		BPD-01	DD-103	K082
C11	.1	600	4241	P688N-1	DF-104	CUB68P1
C12	.1	600	4241	P688N-1	DF-104	CUB68P1
C13	.047	400	4243	BPD-05	DF-503	CUB4847
C14	.047	400	4243	BPD-05	DF-503	CUB4847

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA			
	RESISTANCE	WATTS	ELECTRO-VOICE PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	MALLORY PART No.
R1A	250K	1	J4688	B-51	A47-250K-Z	Q13-130
R2A	10	2	Not Req.	Not Req.	FS-3	Not Req.
R3	1800Ω	2	K4686	Not Req.	Not Req.	U44

RESISTORS

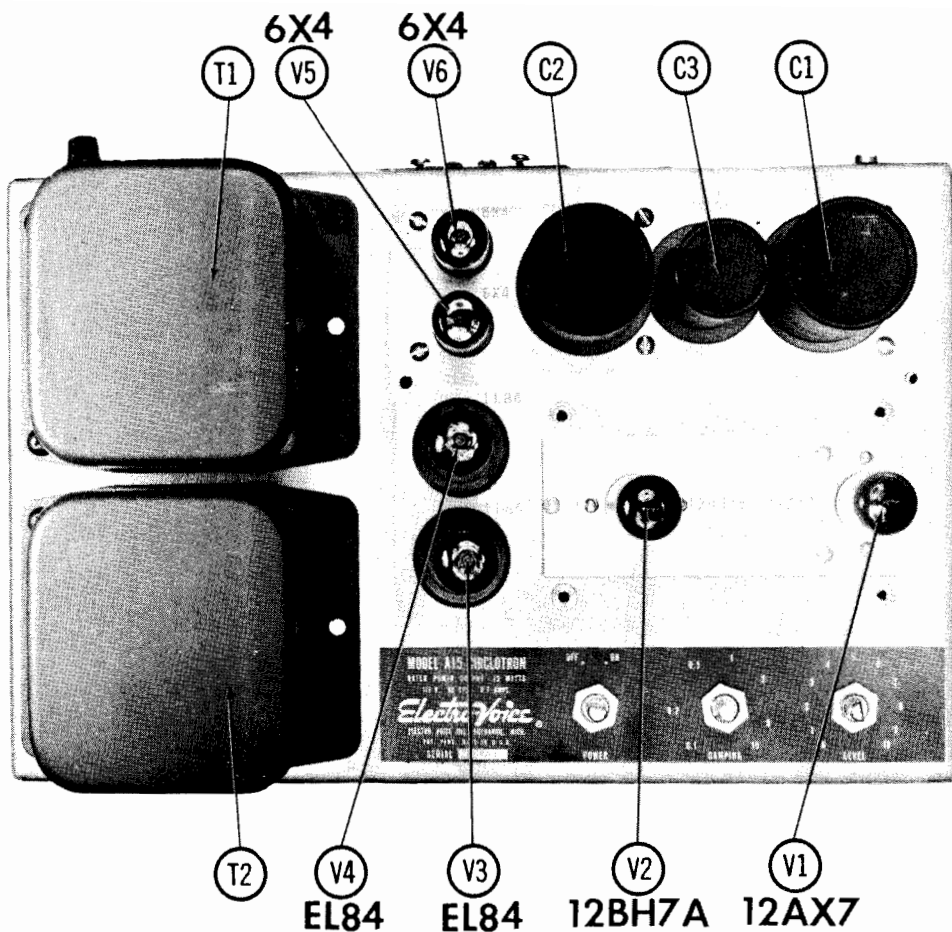
All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA			
	OHMS	WATT	ELECTRO-VOICE PART No.	CENTRALAB PART No.	IRC PART No.	NOTES
R3	270K		4689	BTS-270K		
R4	22K		4681	BTS-22K		
R5	1.2Meg		4686	BTS-1.2Meg		
R6	27K		4651	BTS-27K		
R7	470Ω		4654	BTS-470		
R8	27K		4651	BTS-27K		
R9	470K		4650	BTS-470K		
R10	470K		4650	BTS-470K		
R11	470K		4650	BTS-470K		
R12	12K	2	4679	BTS-12K		
R13	12K	2	4679	BTS-12K		

Note 1. Not used in some versions.

Note 2. Some versions use 3300Ω in this application (Part #46017).

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA			
	PRI.	SEC. 1	SEC. 2	SEC. 3	Electro-Voice PART No.	Hollidson PART No.	Meritt PART No.	Thordarson PART No.
T1	117VAC ④.48A	550VCT ④.024A	550VCT ④.025A	6.3VAC ④3.6A SEC. 4 20V *	1581			

* Bias Supply.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA				NOTES
	PRI.	SEC.	Electro-Voice PART No.	Hollidson PART No.	Meritt PART No.	Thordarson PART No.	
T2	2000Ω	18Ω tap @ 8Ω, 4Ω	1590				

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			Electro-Voice PART No.		LITTELFUSE PART No.		BUSS PART No.	
M1	3AG S/B	1A 125V	FUSE	20171	FUSE	31301.5 (3AG S/B 1A)	HOLDER	MDX 1A HXP

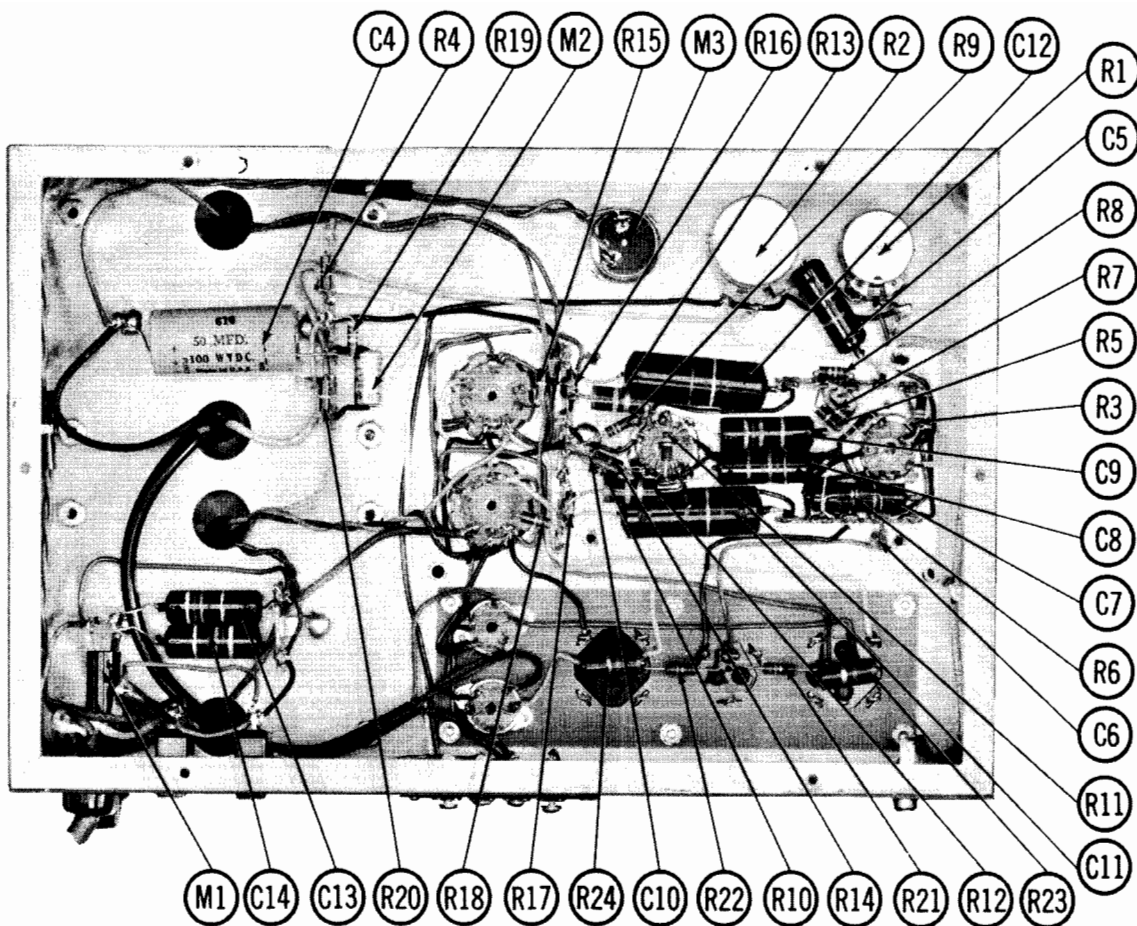
SELENIUM RECTIFIER

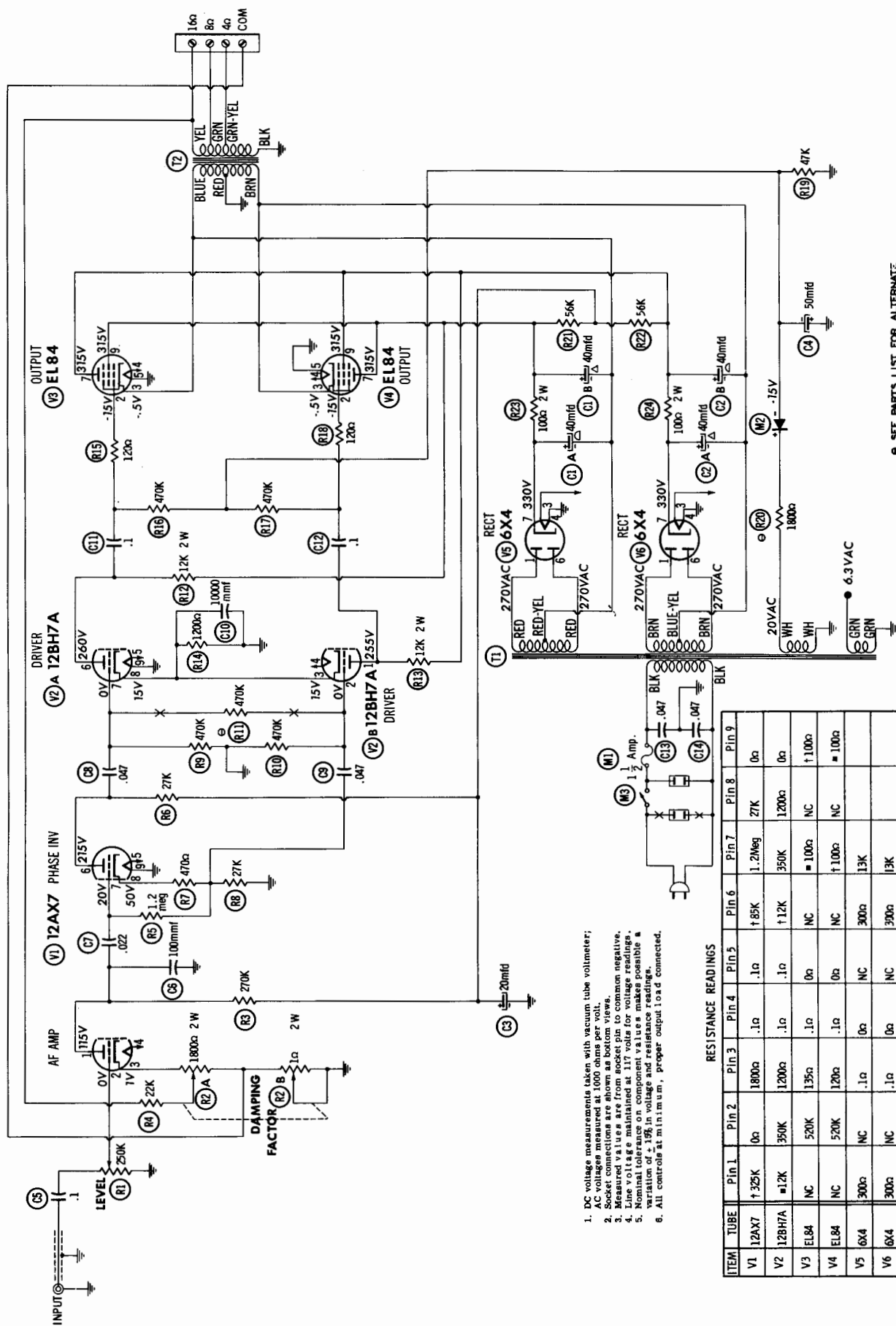
ITEM No.	RATING	REPLACEMENT DATA				NOTES
		Electro-Voice PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	MALLORY PART No.	
342	CURRENT	5914	1159	CR10	8820	SARKES TANZIAN PART No. 10

MISCELLANEOUS

ITEM No.	PART NAME	Electro-Voice PART No.	NOTES
M3	Switch	B5641	On-off (power) SPST

CHASSIS—BOTTOM VIEW





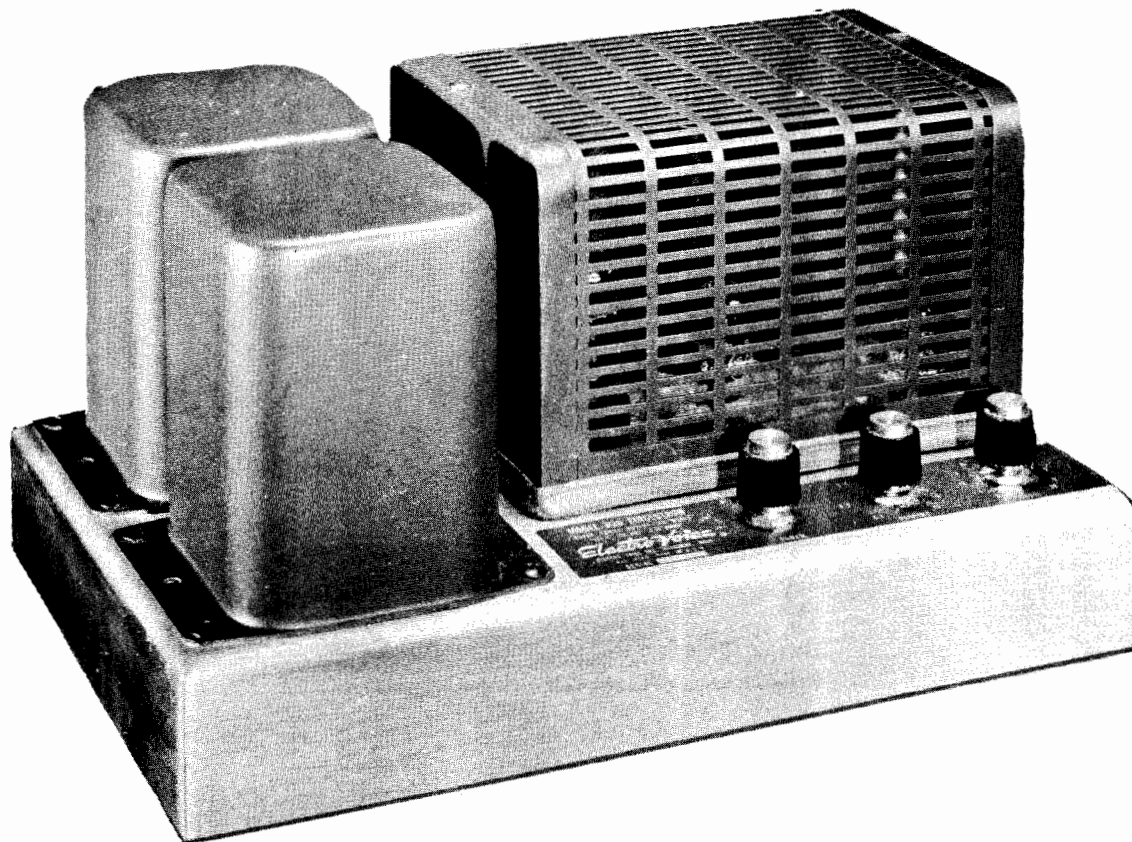
SEE PARTS LIST FOR ALTERNATE
VALUE OR APPLICATION

RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7	100K	100K	100K	100K	100K	100K	100K	100K	100K
V2	12BH7A	100K	100K	100K	100K	100K	100K	100K	100K	100K
V3	EL84	100K	100K	100K	100K	100K	100K	100K	100K	100K
V4	EL84	100K	100K	100K	100K	100K	100K	100K	100K	100K
V5	6X4	100K	100K	100K	100K	100K	100K	100K	100K	100K
V6	6X4	100K	100K	100K	100K	100K	100K	100K	100K	100K

† MEASURED FROM PIN 7 OF V5.
 ‡ MEASURED FROM PIN 7 OF V6.
 NC NO CONNECTION.

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ELECTRO-VOICE
MODEL A20

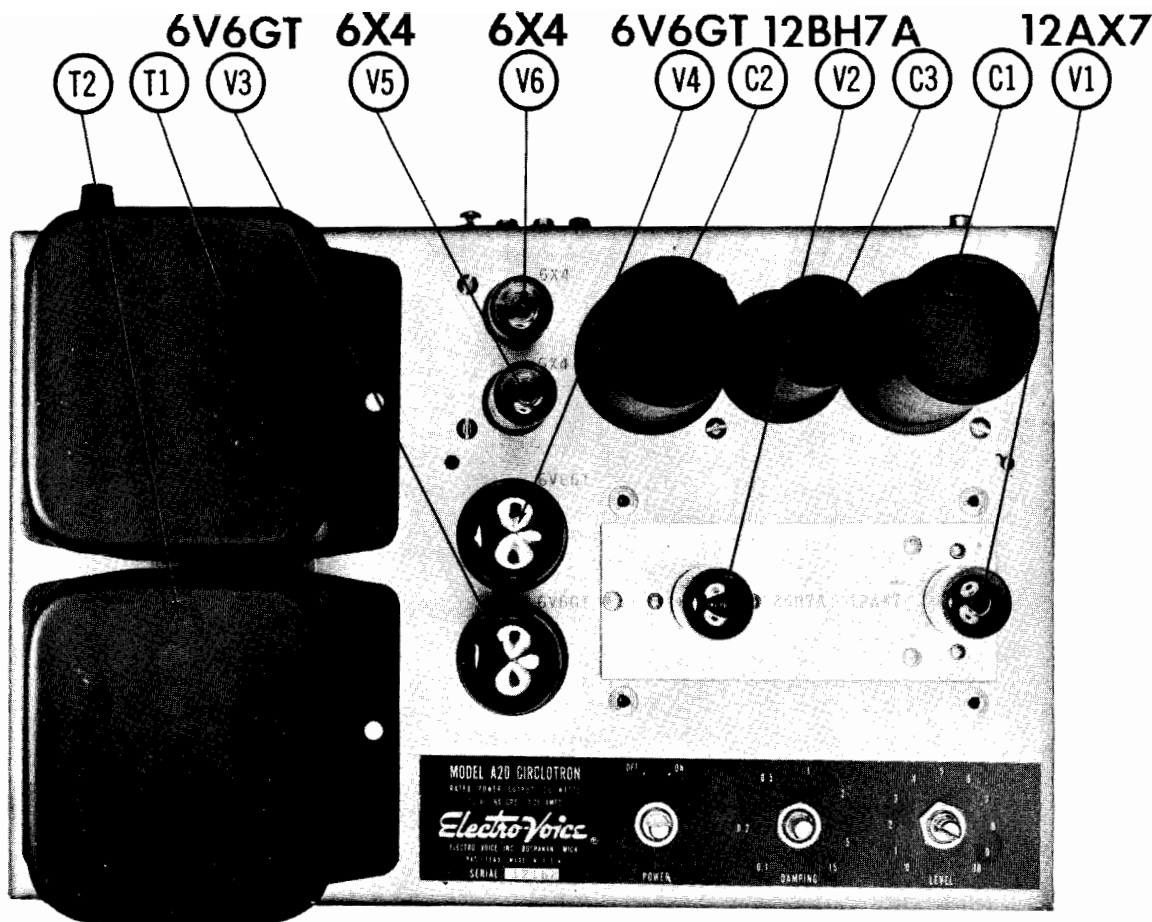
TRADE NAME	Electro-Voice Model A20		
MANUFACTURER	Electro-Voice, Inc., Buchanan, Mich.		
TYPE SET	AC Operated 20 Watt Amplifier		
TUBES (Six)	Types 12AX7 AF Amplifier-Phase Inverter, 12BH7A Driver, (2) 6V6GT Output, (2) 6X4 Rectifier		
POWER SUPPLY	105-125 Volts AC - 60 Cycles	FATING	.59 Amp. @ 117 Volts AC

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CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES	ITEM No.	USE	TYPE	NOTES
V1	AF Amp.-Phase Inv.	12AX7		V4	Output Rectifier	6V6GT	
V2	Driver	12BH7A		V5	Rectifier	6X4	
V3	Output	6V6GT		V6	Rectifier	6X4	

ELECTROLYTIC CAPACITORS

ITEM No.	CAP.	VOLT.	REPLACEMENT DATA				SPRAGUE PART No.
			AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	
C1A	.40	500	4247	B053	FP288	TMD-62	D-275
B	.40	500	4247	B053	FP288	TMD-62	D-275
C2A	.40	500	4247	B053	FP288	TMD-62	D-275
B	.40	500	4247	B053	FP288	TMD-62	D-275
C3	20	450	4246	A046	FP144	TMS-85	S-260
C4	50	100	4242	BR5015	TC48	TD-50-150	FM-1550

* Non-catalog item.

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	CAP.	VOLT.	REPLACEMENT DATA				NOTES
			ELECTRO-VOICE PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	
C5	.1	200	4285	DF-104	CUB2P1	PT401	2TM-P1
C6	.1	100	4281	DD-101	G042	UC-531	5GA-T1
C7	.022	400	4260	BPD-001	CUB4S22	PT4122	4TM-S22
C8	.047	400	4243	BPD-02	DF-503	PT4147	4TM-S47
C9	.047	400	4243	BPD-05	CUB4S47	PT4147	4TM-S47
C10	.047	400	4243	BPD-05	DF-503	PT4147	4TM-S47
C11	.047	400	4243	BPD-05	DF-503	PT4147	4TM-S47
C12	.047	400	4243	BPD-05	DF-503	PT4147	4TM-S47
C13	.047	400	4243	BPD-05	DF-503	PT4147	4TM-S47
C14	.047	400	4243	BPD-05	DF-503	PT4147	4TM-S47

CONTROLS

ITEM No.	RESIST. ANCE	WATTS	REPLACEMENT DATA				INSTALLATION NOTES
			ELECTRO-VOICE PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	
R1A	250K	1/2	J4686	B-51	A47-250K-Z	Q13-130	Level
R2A	10	2	K4688	Not Req.	F8-3	Not Req.	Attach to R1A
R3	18000	2					Damping factor- wire wound

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RESIST. ANCE	WATTS	REPLACEMENT DATA				NOTES
			ELECTRO-VOICE PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	
R3	270K	1/2	4689	BTS-270K		BTS-120	
R4	27K	1/2	4681	BTS-27K		BTS-470K	
R5	1.2Meg	1/2	4686	BTS-1.2Meg		BTS-470K	
R6	27K	1/2	4681	BTS-27K		BTS-120	
R7	470K	1/2	4684	BTS-470K		BTS-47K	
R8	27K	1/2	4681	BTS-27K		BTS-1000	
R9	470K	1/2	4685	BTS-470K		BTS-56K	
R10	470K	1/2	4685	BTS-470K		BTS-56K	
R11	12K	1/2	4678	BTS-12K		BTS-100	
R12	12K	1/2	4678	BTS-12K		BTS-100	
R13	12000	1/2	4658	BTS-12000		BTS-100	

PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA			
	PRI.	SEC. 1	SEC. 2	SEC. 3	Electro-Voice PART No.	Hollidson PART No.	Merit PART No.	Stancor PART No.
T1	117VAC @ .59A	710VCT @ .025A	6.3VAC @ .025A	SEC. 4 20VAC *	1580			

* Bias supply.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA				NOTES
	PRI.	SEC.	Electro-Voice PART No.	Hollidson PART No.	Merit PART No.	Stancor PART No.	
T2	20000	160 tap @ 8Ω, 4Ω	1579				

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA			
			Electro-Voice PART No.	FUSE	HOLDER	BUSS PART No.
M1	3AG S/B	1 1/4 125V		33301.5 (3AG S/B 1 1/4A)	342001	MDL 1 1/4 HRP

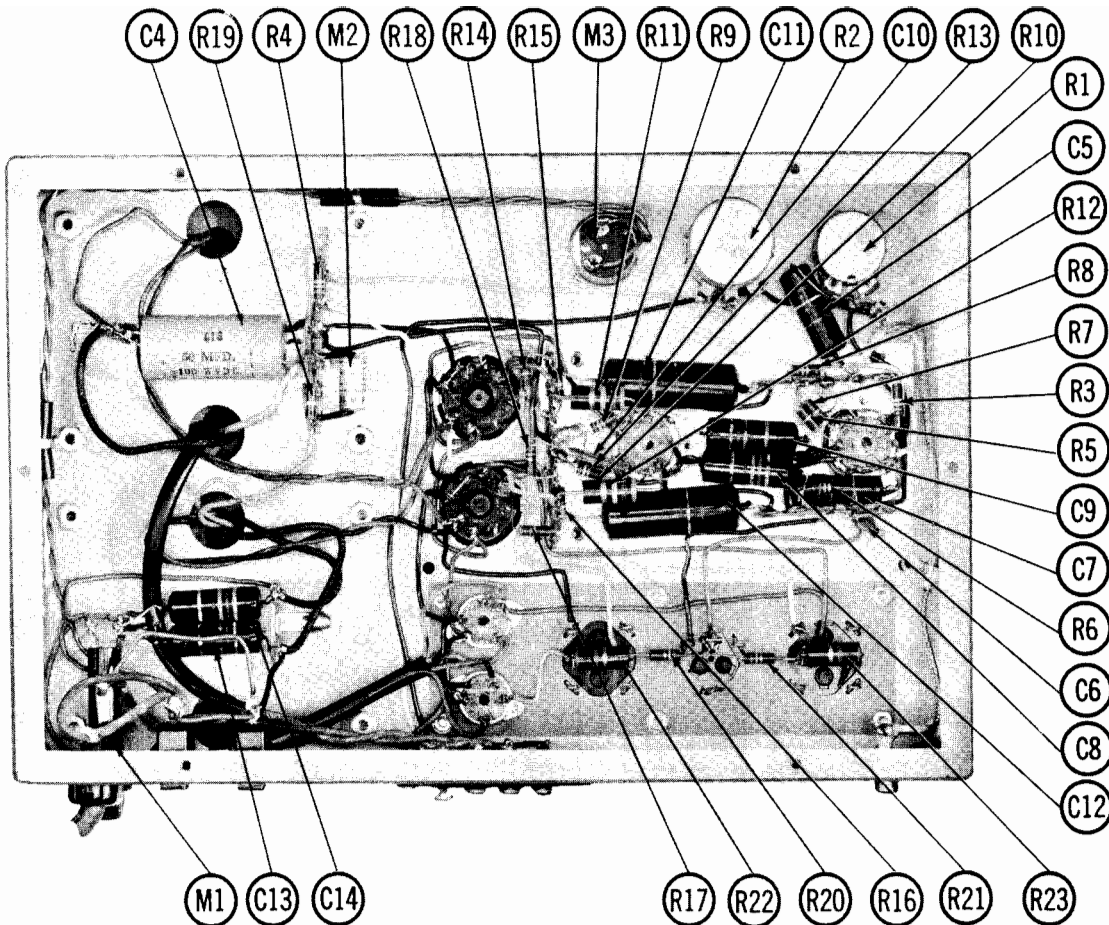
SELENIUM RECTIFIER

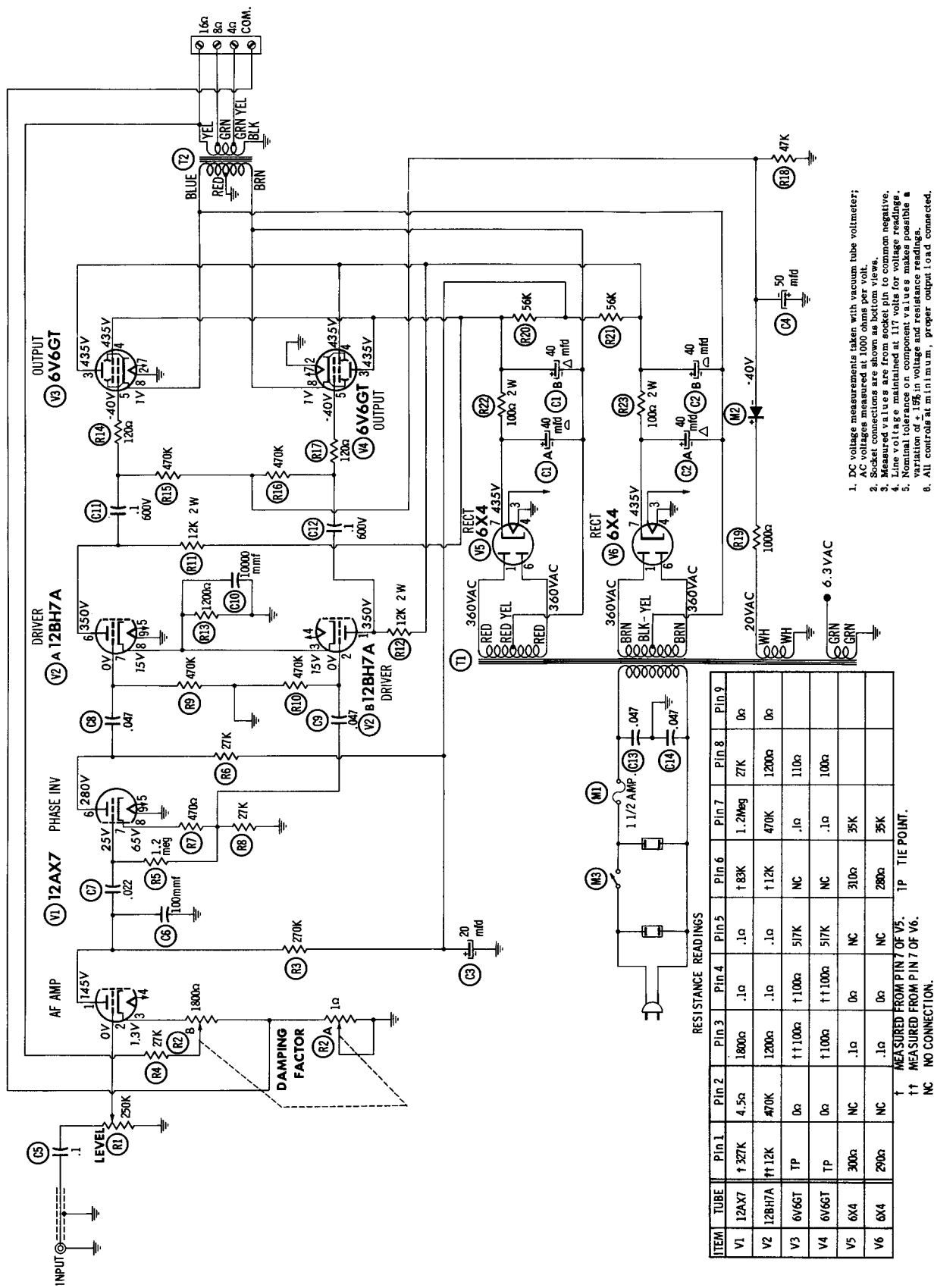
ITEM No.	RATING	CURRENT	REPLACEMENT DATA				NOTES
			Electro-Voice PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	MALLORY PART No.	
M2			5814	1159	CR10	8820	SARKES TARZIAN PART No. 10

MISCELLANEOUS

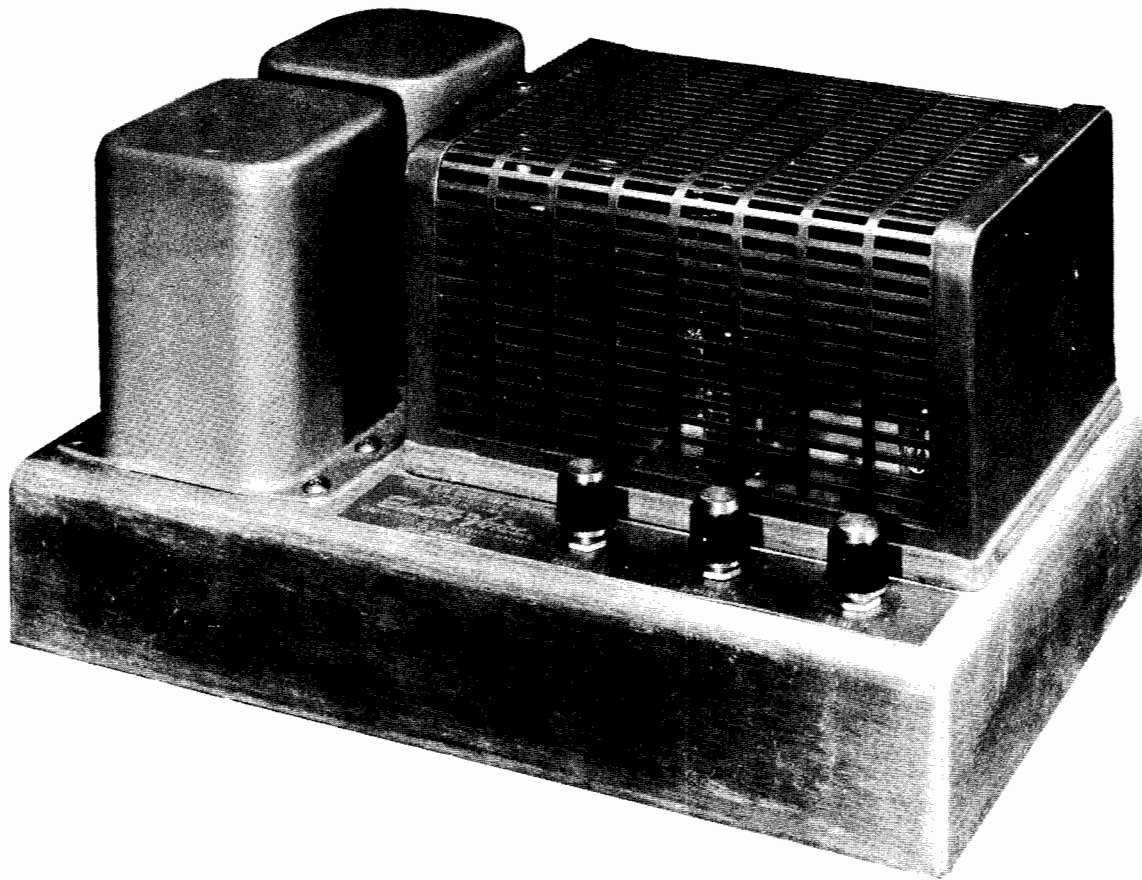
ITEM No.	PART NAME	Electro-Voice PART No.	NOTES
M3	Switch	B5641	On-off (power) SPST

CHASSIS—BOTTOM VIEW





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**ELECTRO-VOICE
MODEL A30**

TRADE NAME	Electro-Voice Model A30	
MANUFACTURER	Electro-Voice, Inc., Buchanan, Michigan	
TYPE SET	AC Operated 30 Watt Audio Amplifier	
TUBES (Six)	Types 12AX7 AF Amp. -Phase Inv., 12BH7A Driver, (2) 1614 Output, (2) 5Y3GT Rectifier	
POWER SUPPLY	105-125 Volts AC - 60 Cycles	RATING 1 Amp. @ 117 Volts AC (110 Watts)

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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G853

CHASSIS—TOP VIEW

ITEM No.	USE	TYPE	NOTES
V1	AF Amp -Phase Inverter	12AX7	
V2	Driver	12BH7A	
V3	Output	18L4	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT.	Electro-Voice PART No.	AEROVOX PART No.	CORNEILL- DUBNER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
440	500	4247	AFH2-72	BO530	F2288	TMD-82	D-275	TVL-2940	
440	500	4247	AFH2-72	BO530	F2288	TMD-82	D-275	TVL-2940	
440	500	4246	AFH1-50	AR460	F1444	TMS-55	S-260	TVL-1714	
440	500	4242	PRSI50V5	HC5015	TC49	TD-50-150	FM-1550	TVA-1414	
500	4242								

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP. VOLT	REPLACEMENT DATA							NOTES
		Electro-Voice PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL- DUBILIER PART No.	ERIE PART No.	MALLOY PART No.	SPRAGUE PART No.	
C5	.1	4285	P288N-1	DF-104	CUB32P1	ED-100	GEM-401	2TM-P1	Note 1
C6	100	4281	BPD-0001	DD-101	L10T1	ED-02	UC-531	4GA-J1	
C7	.022	4280	BPD-02	DD-203	CUB4S22	ED-02	GEM-4122	5TM-S22	
C8	.022	4280	BPD-02	DD-203	CUB4S22	ED-02	GEM-4122	4TM-S22	
C9	.1	4281	P688N-1	DF-104	CUB6P1		GEM-601	6TM-P1	
C10	10000	4287	BPD-01	DD-103	BYA6SL	GP-10000	DC511	5HK-S1	
C11	.022	4280	BPD-02	DD-203	CUB4S21	ED-02	GEM-4122	4TM-S22	
C12	.1	4241	P688N-1	DF-104	CUB6P1		GEM-601	6TM-P1	
C13	.047	4243	BPD-05	DF-503	CUB4S47		GEM-4147	4TM-S47	
C14	.047	4243	BPD-05	DF-503	CUB4S47		GEM-4147	4TM-S47	
C15	.05	1600	P1888N-05	DF-503	CUB16S5		GEM-1815	16TM-S5	Note 1
C16	.05	1600	P1888N-05	DF-503	CUB16S5		GEM-1815	16TM-S5	

Note 1: Not used in some versions.

CONTROLS

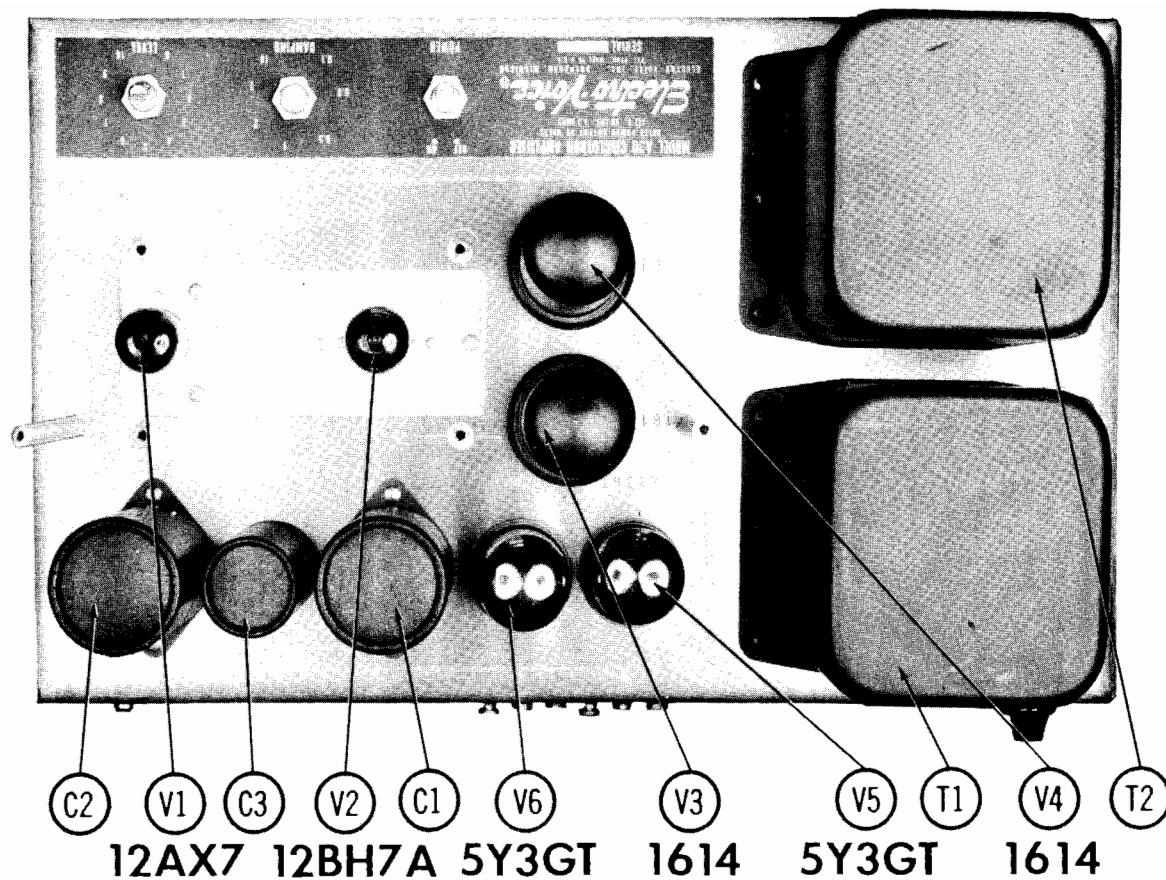
ITEM No.	RATING		REPLACEMENT DATA						INSTALLATION NOTES
	RESIST-ANCE	WATTS	Electro-Voice Part No.	CENTRALAB Part No.	CLAROSTAT Part No.	IRC Part No.	MALLORY Part No.		
RIA	250K	1	J4886	P-51	A47-250K-Z	Q13-130	U44	Level Damping (Wire-wound) Damping (Wire-wound)	
REB	Shaft			Not Req.		Not Req.	Not Req.		
ICQ	2		K4886		FS-3				
R2A	1800Ω	2							

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING			REPLACEMENT DATA			NOTES
	OHMS	WATT	ELECTRO- PART No.	RATING	REPLACEMENT DATA		
					OHMS	WATT	
R3	270K		4689			BTS-270K	
R4	2.70 5%	1	4690			BTS-33K	
R5	33K		4685			BTS-1.2Meg	
R6	1.2M		4656			BTS-27K	
R7	27K		4651			BTS-470K	
R8	470K		4654			BTS-47K	
R9	27K		4651			BTS-27K	
R10	56K		4652			BTS-56K	
R11	56K		4652			BTS-56K	
R12	470K		4650			BTS-470K	
R13	12K	2	4679			BTS-12K	
R14	470K		4650			BTS-470K	
R15	12K	2	4679			BTS-12K	
R16				1200Ω			
R17				470K			
R18				470K			
R19				1200Ω			
R20				1000Ω			
R21				47K			
R22				470K			
R23				470K			
R24				1200Ω			
R25				1000Ω			
R26				1000Ω			
R27				100Ω	4		
R28				100Ω	4		

Note 1: Not used in some versions.



PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (POWER)

ITEM No.	RATING			REPLACEMENT DATA			
	PRI.	SEC. 1	SEC. 2	SEC. 3	Electro-Voice PART No.	Meritt PART No.	Thordarson PART No.
T1	117VAC ① 1A	760VCT ② .050A	760VCT ③ .050A	48VAC ④ 0.0A (Bias winding) SEC. 5 5VAC ⑤ 3A	1584		
				SEC. 6 5VAC ⑥ 2.7A			

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA					NOTES
	PRI.	SEC.	Electro-Voice PART No.	Halldorson PART No.	Meritt PART No.	Stancor PART No.	Thordarson PART No.	
T2	1600Ω	180 CT Tap@ 80, 40 70V	1593					

SELENIUM RECTIFIER

ITEM No.	RATING	REPLACEMENT DATA					NOTES
		Electro-Voice PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	RADIO RECEPTOR PART No.	SARKES TARZIAN PART No.	
M1		5914	1159	CR10	8520	10	

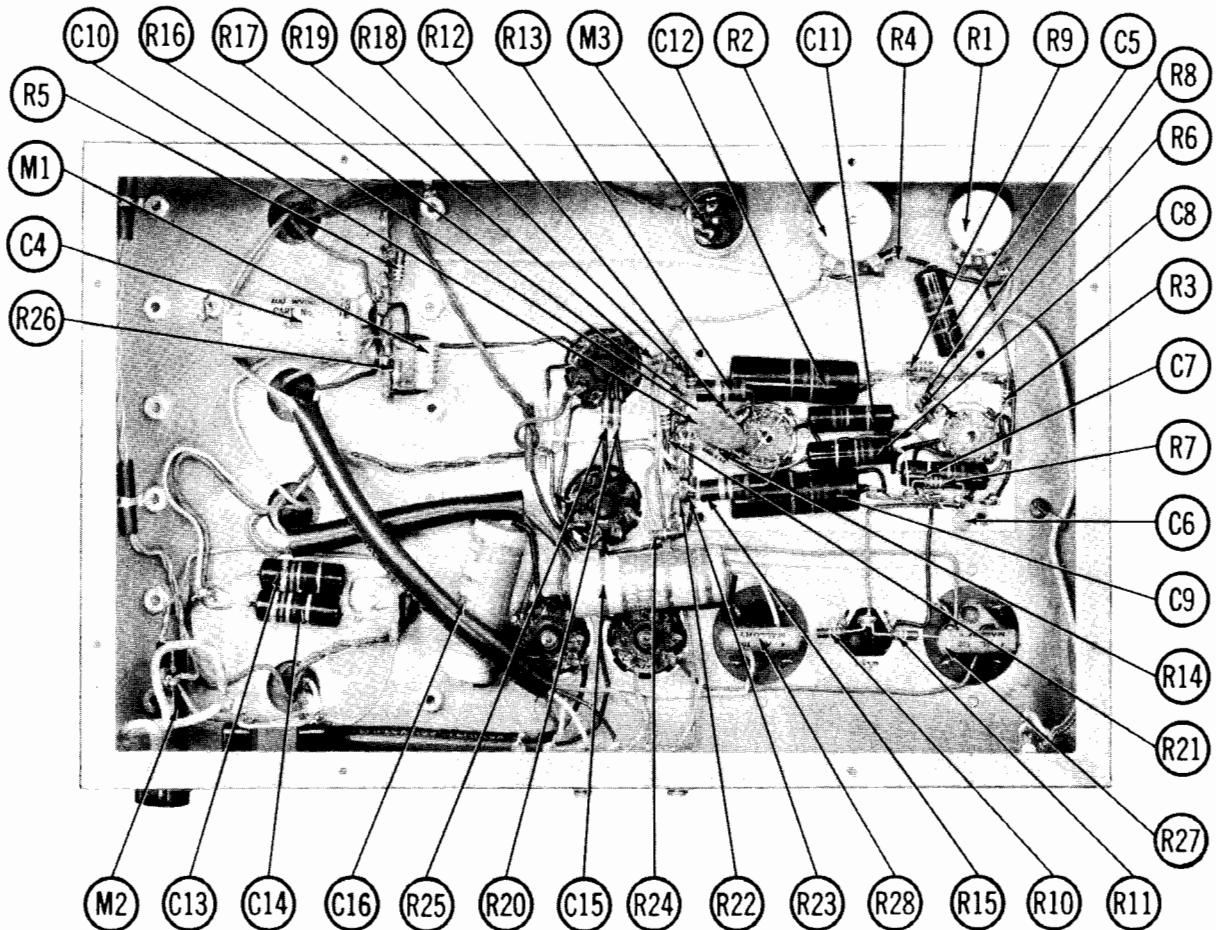
FUSES

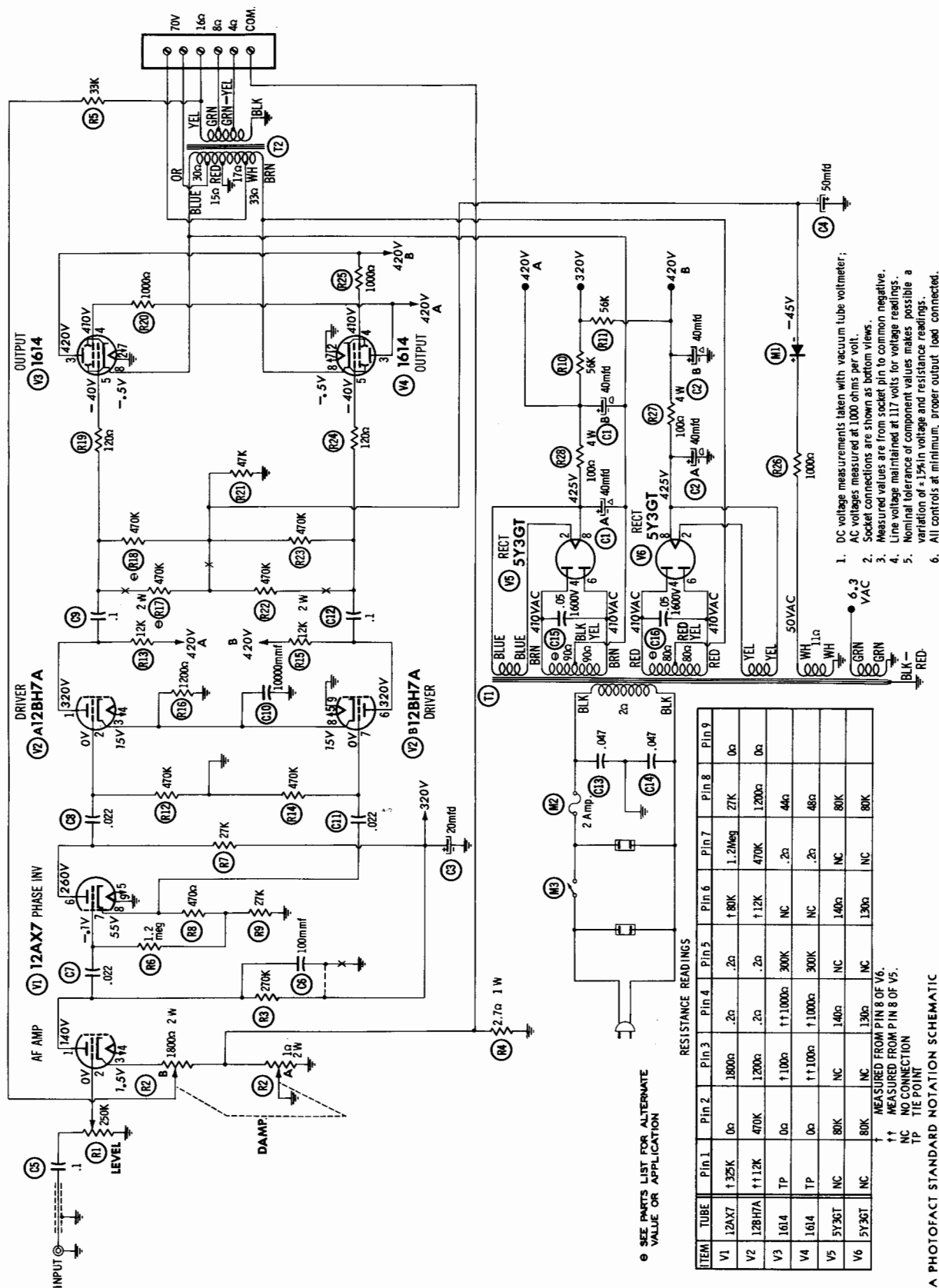
ITEM No.	TYPE	RATING	REPLACEMENT DATA			
			Electro-Voice PART No.	LITTELFUSE PART No.	Buss PART No.	Notes
M2	3AG S/B	2A 125V	FUSE 20143	FUSE 313002 (3AG-S/B-2A)	FUSE MDX 2	HOLDER HXP

MISCELLANEOUS

ITEM No.	PART NAME	Electro-Voice PART No.	Notes
M3	Switch	B5641	On-Off, Rotary

CHASSIS—BOTTOM VIEW







ELECTRO-VOICE
MODEL PC2

TRADE NAME	Electro-Voice Model PC2	
MANUFACTURER	Electro-Voice Inc., Buchanan, Mich.	
TYPE SET	AC Operated Equalizer Preamplifier	
TUBES (Three)	Types 12AX7 Phono Preamplifier, 12AX7 AF Amplifier, 6X4 Rectifier	
POWER SUPPLY	105-125 Volts AC - 60 Cycles	RATING . 22 Amp. @ 117 Volts AC

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PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES	ITEM No.	USE	TYPE	NOTES
V1	Phono Pre-amplifier	12AX7		V3	Rectifier	6X4	
V2	A.F. Amplifier	12AX7					

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA					
	CAP.	VOLT.	ELECTRO-VOICE PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.
C1A	20	350	42045			EP434.5		Q-0300
C1B	20	350				TC82		MT-4320
C2	12	500	(Note 1)	PRS250V12	BBR12-250	TC53	TD-12-250	FM-2512
C3	20	25	42046	PRS50V20	BBR20-25	TC26	TD-25-25	FM-0225

Note 1: Not used in some versions.

FIXED CAPACITORS

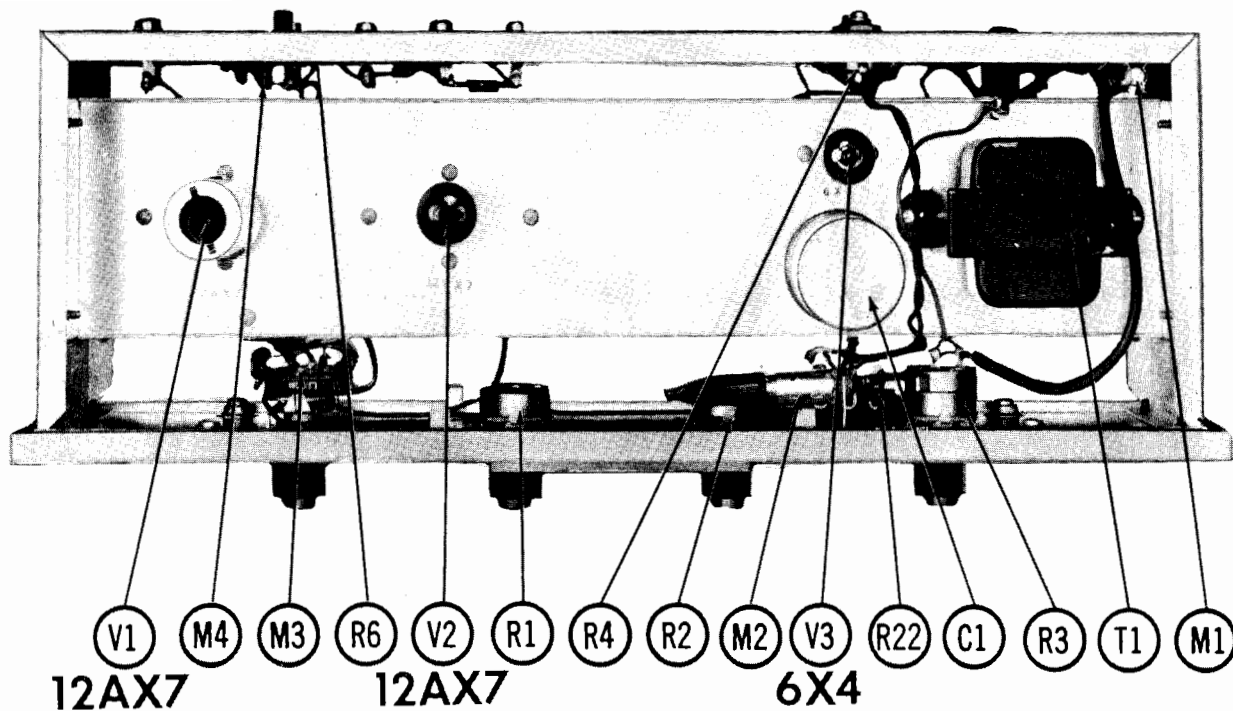
Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA						NOTES
	CAP.	VOLT.	ELECTRO-VOICE PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	
C4	10000		4252	BPD-01	DD-103	BYA6S1	GP-10000	DC511	5HK-S1
C5	5000		42002	BPD-005	DD-502	BYA10D5	GP-5000	DC525	5HK-D5
C6	10000		4252	BPD-01	DD-103	BYA6S1	GP-10000	DC511	5HK-S1
C7	2000		4252	BPD-002	DD-202	BYA10D2	GP-2000	DC522	5HK-D2
C8	10000		4252	BPD-01	DD-103	BYA6S1	GP-10000	DC511	5HK-S1
C9	.1	400	4245	P488N-1	DF-104	CUB4P1	ED-500	GEM-401	4TM-P1
C10	500		42003	BPD-0005	DD-501	BYA10T5	ED-500	UC-535	5GA-T5
C11	500		42003	BPD-0005	DD-501	BYA10T5	ED-500	UC-535	5GA-T5
C12	.1	400	4245	P488N-1	DF-104	CUB4P1	ED-500	GEM-401	4TM-P1
C13	200		4256	BPD-0002	DD-201	LI0T2	ED-200	UC-532	5GA-T2
C14	2000		4259	BPD-002	DD-202	BYA10D2	GP-2000	DC522	5HK-D2
C15	10000		4257	BPD-01	DD-103	BYA6S1	GP-10000	DC511	5HK-S1
C16	1000		4258	BPD-001	DD-102	BYA6D2	ED-1000	DC521	5HK-D1
C17	.1	400	4245	P488N-1	DF-104	CUB4P1	ED-1000	GEM-401	4TM-P1

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA						INSTALLATION NOTES
	RESIST. ANCE	WATTS	Electro-Voice PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.		
R1A	50K		A48086	B-32	A47-50K-Z	Q13-123	U33	Volume	
R2A	B Shaft		A4886	Not Req.	FS-3	Not Req.	Not Req.	Treble	
R3A	B Shaft		Z4886	Not Req.	A47-1Meg-Z	Q13-137	U53	Bass	
R4A	B Shaft			Not Req.	FS-3	Not Req.	Not Req.		
R5A	Switch			KB-1	SWE-12	76-1	US-26		
R6A	5000	1	R4886	AB-4	A47-500-S	Q11-103	U2	Hum Balance (Ceramic)	
R7A	5000			AK-1	FKS-1/4	RQ	Not Req.		
R8A	5000	1	R4886	AB-4	A47-500-S	Q11-103	U2	Hum Balance (Magnetic)	
R9A	5000			AK-1	FKS-1/4	RQ	Not Req.		

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING	REPLACEMENT DATA		ITEM No.	RATING	REPLACEMENT DATA		NOTES
		OHMS	WATT			OHMS	WATT	
R6	22Meg	4806		R20	4700Ω			
R7	47K	4668		R21	120K	4675		
R8	120K	4670		R22	12K	4670		
R9	2200Ω	4676		R23	120K	4670		
R10	12Meg	4672		R24	18K	46029		
R11	120K	4670		R25	680Ω	48045		
R12	1.2Meg	4656		R26	390K	48028		
R13	120K	4670		R27	330K	4656		
R14	1.2Meg	4656		R28	1.2Meg	4656		
R15	270K	4669		R29	47K	4668		
R16	1.8Meg	4673		R30	47K	4668		
R17	50K	4652		R31	27K	4651		
R18	1200Ω	4658		R32	1.2Meg	4656		
R19				R33	120K	4670		

Note 1: Not used in some versions.

TRANSFORMER (POWER)

ITEM No.	RATING			REPLACEMENT DATA			
	PRI.	SEC. 1	SEC. 2	Electro-Voice PART No.	Merit PART No.	Stencor PART No.	Tried PART No.
T1	117VAC ② 22A	455VCT ② .055A	6.3VAC ② .3A	15021			

FUSES

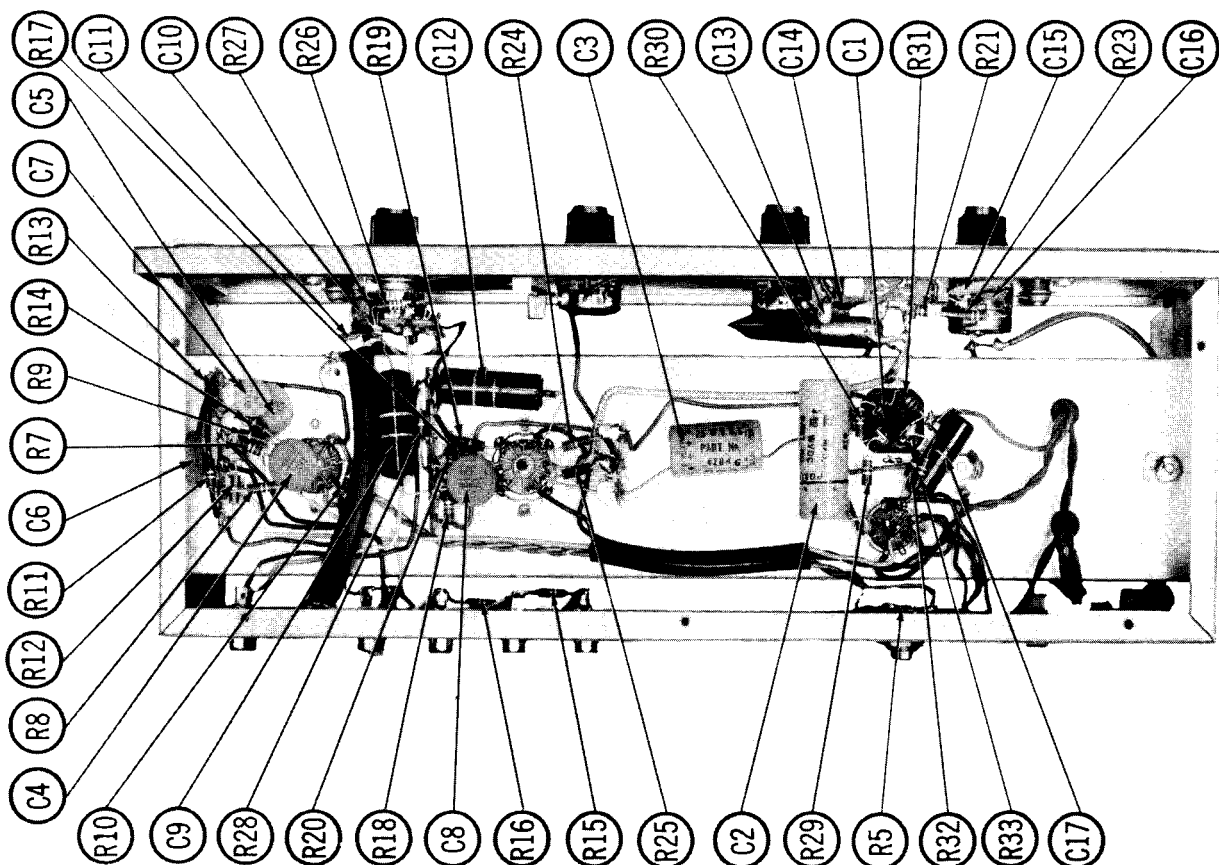
ITEM No.	TYPE	RATING	REPLACEMENT DATA			
			Electro-Voice PART No.	LITTELFUSE PART No.	BUSS PART No.	
M1	3AG	1/2A 250V	(Note 1)	312,500 (3AG-1A-250V)	FUSE AGC 1/2	HOLDER 4405

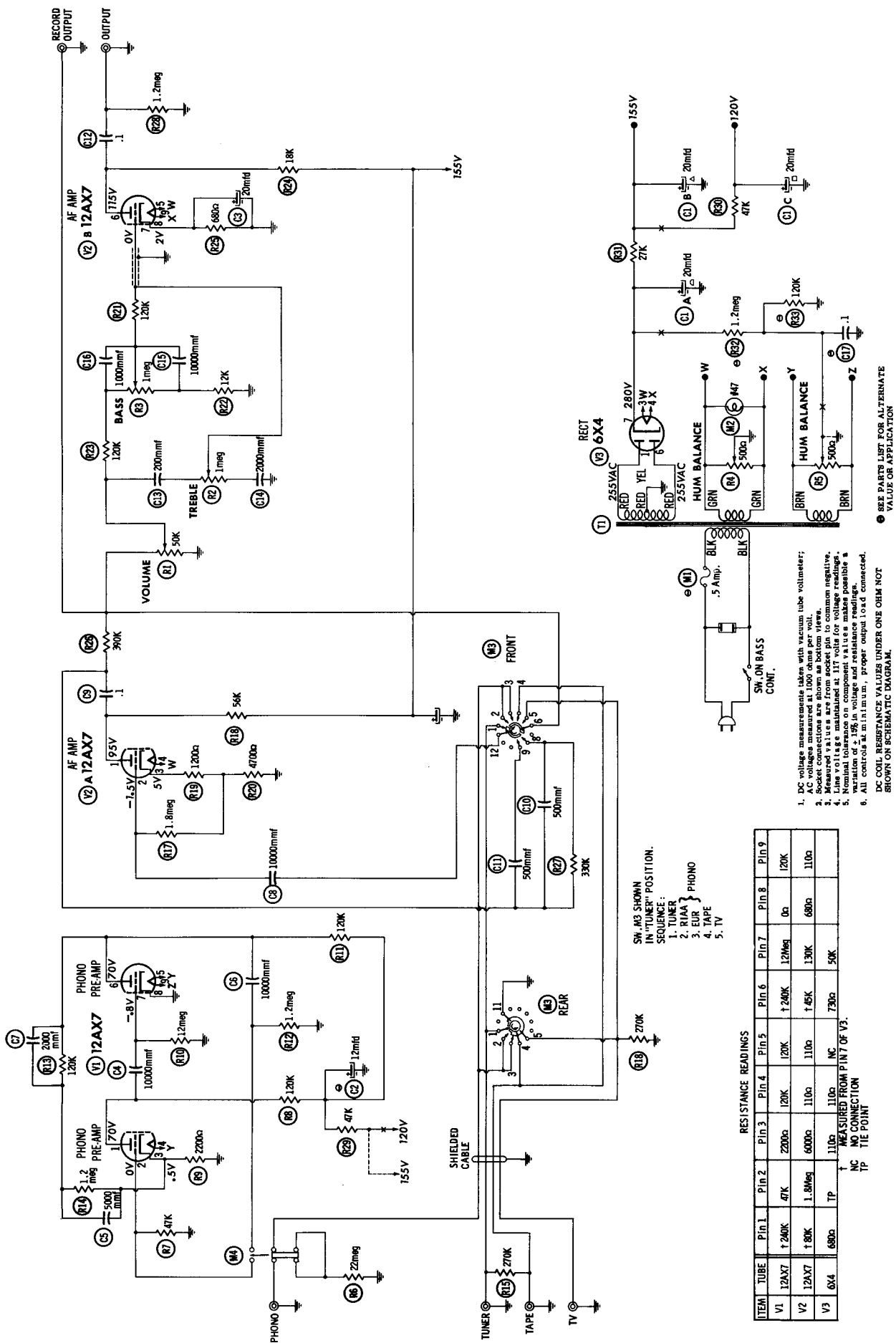
Note 1: Some versions may use 3AG, 1/2A, 250V, S/B (Part #Z-20066) in this application.

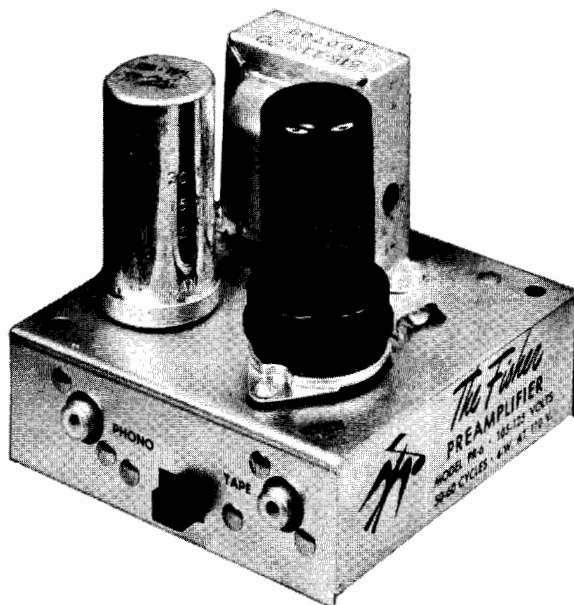
MISCELLANEOUS

ITEM No.	PART NAME	Electro-Voice PART No.	NOTES
M2	Pilot Light		
M3	Switch		
M4	Switch		

CHASSIS—BOTTOM VIEW







TRADE NAME Fisher Model PR-6

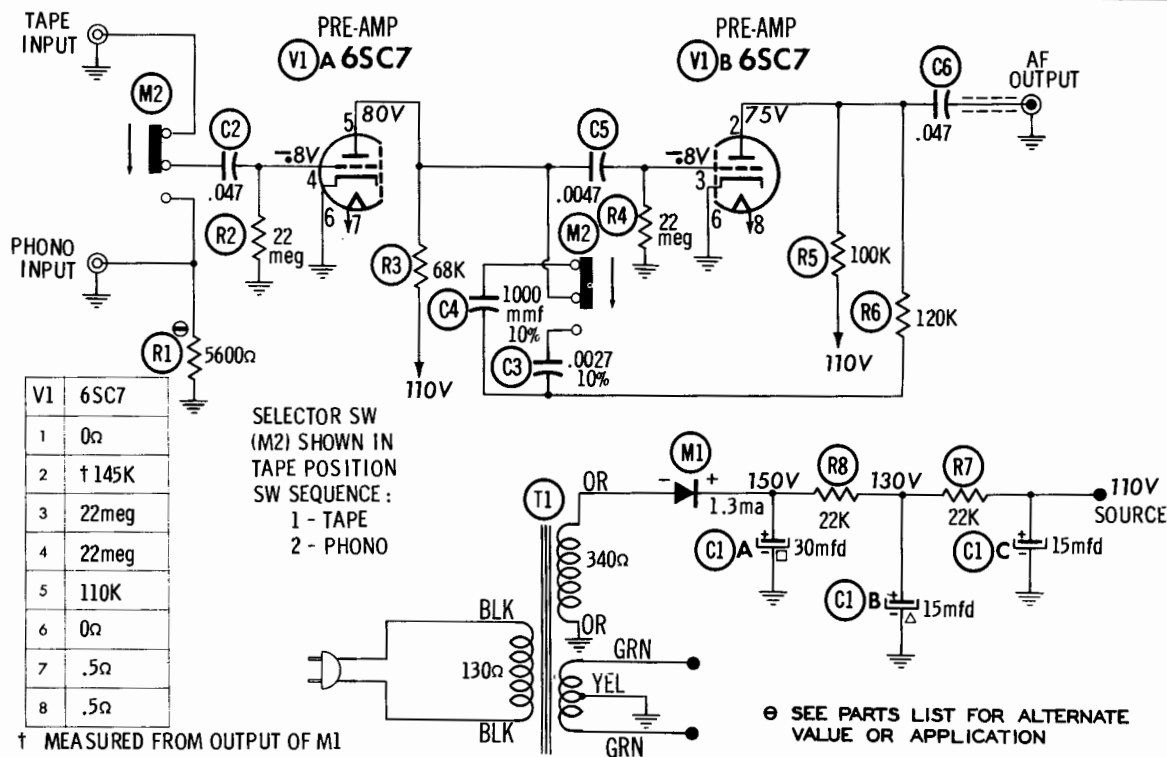
MANUFACTURER Fisher Radio Corp., 21-21 44th Drive, Long Island City 1, N. Y.

TYPE SET AC Operated Preamplifier

TUBES (One) Type 6SC7 Preamplifier

POWER SUPPLY 105-125 Volts AC-50/60 Cycle

RATING .04 Amp. @117 Volts AC (4 Watts)



A PHOTOFACT STANDARD NOTATION SCHEMATIC

Howard W. Sams & Co., Inc. 1958

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FISHER
MODEL PR-6

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES	ITEM No.	USE	TYPE	NOTES
V1	Preamplifier	6SC7					

ELECTROLYTIC CAPACITORS

ITEM No.	RATING				REPLACEMENT DATA			
	CAP.	VOLT.	FISHER PART No.	CORNELL-DUBILIER PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.
C1A	30	150	C515-122	AFH3-17-50	C0070	FT311-4	TMT-7	T-035
C1B	15	150						TVL-3437
C1C	15	150						

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		FISHER PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	REPLACEMENT DATA			NOTES
	CAP.	VOLT.				ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C2	.047	200	C68P473M2	P288N-047	DF-503	CUB2547	GEM-4147	2TM-547	
C3	.0027	200	C68P272K2						
C4	.0047	200	C68P472F2						
C5	.0047	200	C68P472F2						
C6	.047	200	C68P473M2						

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		FISHER PART No.	NOTES	ITEM No.	RATING		FISHER PART No.	NOTES
	OHMS	WATT				OHMS	WATT		
R1	5000		RC20BF562K	Note 1	R5	100K		RC20BF104K	
R2	22meg		RC20BF225K		R6	120K		RC20BF124K	
R3	68K		RC20BF683K		R7	22K		RC20BF223K	
R4	22meg		RC20BF228K		R8	22K		RC20BF223K	

Note 1 Chassis with pickering cartridge use 3900Ω in this application

TRANSFORMER (POWER)

ITEM No.	RATING			FISHER PART No.	Heildorson PART No.	Merit PART No.	Ram PART No.	Stencor PART No.	Thordorson PART No.
	117V	115V	6.3VCT						
T1	.04A	.0013A	.0013A	T-515-118					

SELENIUM RECTIFIER

ITEM No.	RATING			FISHER PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	SARKES PART No.	NOTES
	CURRENT (Measured)	SEC. 1	SEC. 2					
M1	.0013A			SR3180	1159	CR-20	10	① Pig Tail Leads

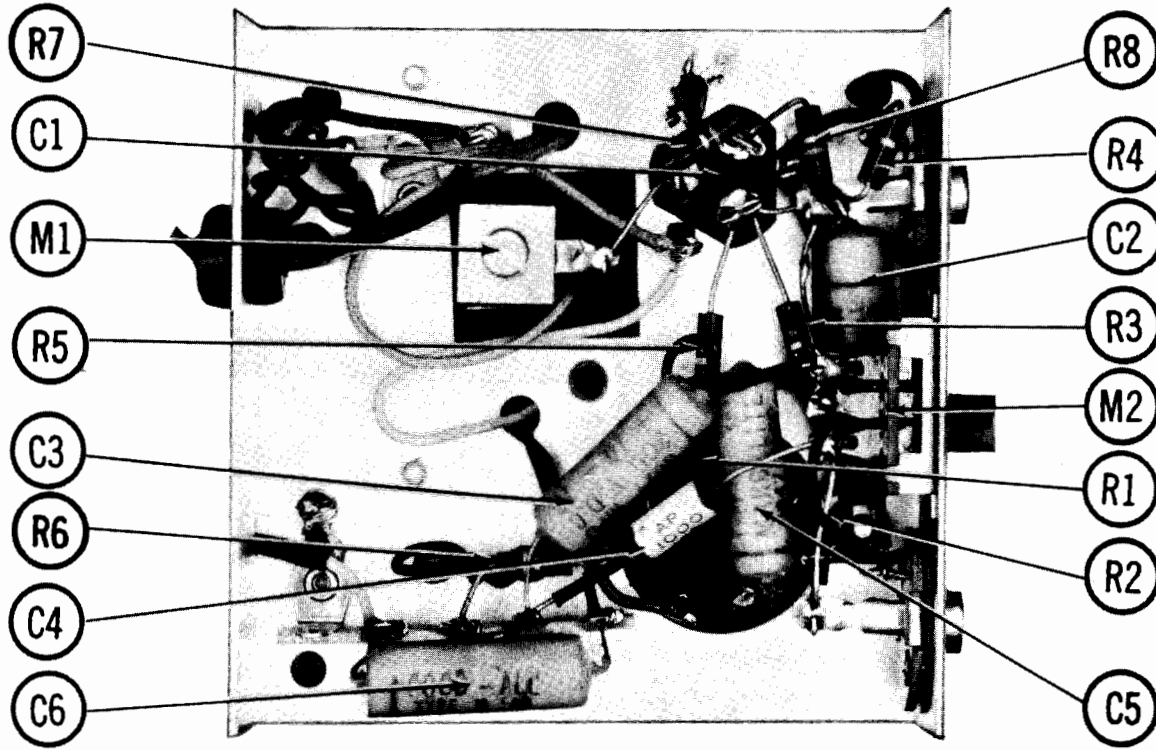
MISCELLANEOUS

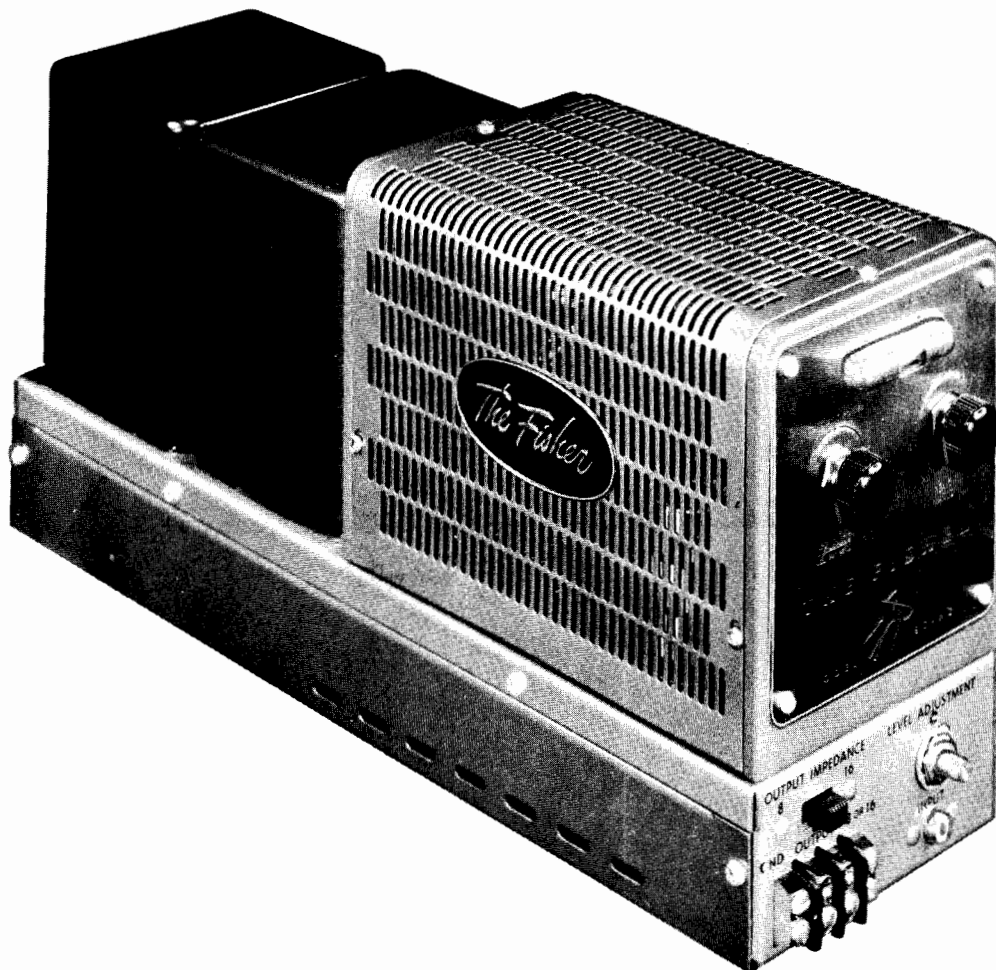
ITEM No.	PART NAME	FISHER PART No.	NOTES
M2	Switch	S-505-117	Phono-Tape (Slide Type DPDT)

WIRING DATA

General-use Unshielded Hook-up Wire Use BELDEN No. 8530 (Solid) Available in Ten Colors
 Power Cord Use BELDEN No. 8524 (Stranded) Available in Ten Colors
 Low-Loss Shielded Lead (Interconnecting) Use BELDEN No. 1765-B (6 Ft. Length)
 Phono Pick-up Arm Cable Use BELDEN No. 1725-K (7½ Ft. Length)
 Use BELDEN No. 8430 (Two Conductor - Twisted)

CHASSIS—BOTTOM VIEW





FISHER
MODEL 80-AZ

TRADE NAME	Fisher Model 80-AZ
MANUFACTURER	Fisher Radio Corp., 21-21 44th. Drive, Long Island City 1, N. Y.
TYPE SET	AC Operated 30 Watt Audio Amplifier
TUBES (Five)	Types 12AT7 AF Amp.-Phase Inv., 12AU7A Driver, (2) 6X4 Output, 5Y4G Rectifier
POWER SUPPLY	105-125 Volts AC-50/60 Cycles
	RATING 1 Amp. @ 117 Volts AC

PHASE INVERTER BALANCE ADJUSTMENT

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Disconnect the speaker and connect a 16 ohm, 20 watt resistor to "GND" and "16". 2. Connect the audio generator to the amplifier input. 3. Switch IMPEDANCE SELECTOR to "16". 4. Turn Z-Matic control fully counter clockwise. 5. Connect the wave analyzer or distortion analyzer across the 16 ohm resistor. | <ol style="list-style-type: none"> 6. Set the audio generator to 1000 cycles and adjust the attenuator so that the amplifier produces 20 watts (17.85 volts RMS) across the 16 ohm resistor. 7. Tune the wave analyzer to the second harmonic of 1000 cycles or, if a distortion analyzer is used, tune it for minimum reading at 1000 cycles. 8. Adjust the phase inverter balance control (R4) for minimum distortion. |
|---|---|

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G621

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES	ITEM No.	USE	TYPE	NOTES
V1	AF Amp.-Phase Inv.	12AT7		V4	Output Rectifier	EL-37	
V2	Driver	12AU7A		V5		5V4G	
V3	Output	EL-37					

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA									
	CAP.	VOLT.	FISHER PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.			
C1A	.40	500	C-522-114	APF2-72	B0530	FP288	TMD-62	D-275	TVL-2940			
C1B	.40	500										
C2A	.40	450	C-1768	APF2-57	B0450	FP238	TMD-54	D-235	TVL-2764			
C3	.50	50	C-508-115	PRS50V50	BR505	TC39	TD-50-50	FM-0550	TVL-1308			

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA										NOTES
	CAP.	VOLT	FISHER PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.				
C4	.22	200	C69P224V2	P268N-22	D6-221	CUB2P22	811-221	PT4022	2TM-P22	Note 1 Note 1			
C5	.220	400	CC-21GP221K3	NPO-81220		2BR5T22	817-02	PT4322	5TCC-T22				
C6	.022	400	86P223M4	P468N-022		CUB4522	817-02	PT4322	4TM-S22				
C7	.022	400	86P223M4	P468N-022		CUB4522	817-02	PT4322	4TM-S22				
C8	.1	400	68P104M4	P468N-1	DF-104	CUB4P1		PT401	4TM-P1				
C9	.1	400	68P104M4	P468N-1	DF-104	CUB4P1		PT401	4TM-P1				
C10	.0005	5000	C-508-122	DI-005	DD-502	K080	811-005	DC-525	5GA-D5				
C11	.047	800	C-68P473M6	BPD-05	DF-503	CUB6847	801-820	PT6147	8TM-S47				
C12	.82	420		M468-000082	D6-820	T228			MB-482				
C13	.01	800	C-2747	BPD-01	D6-103	CUB681	GP3-333-103	PT611	8TM-S1				

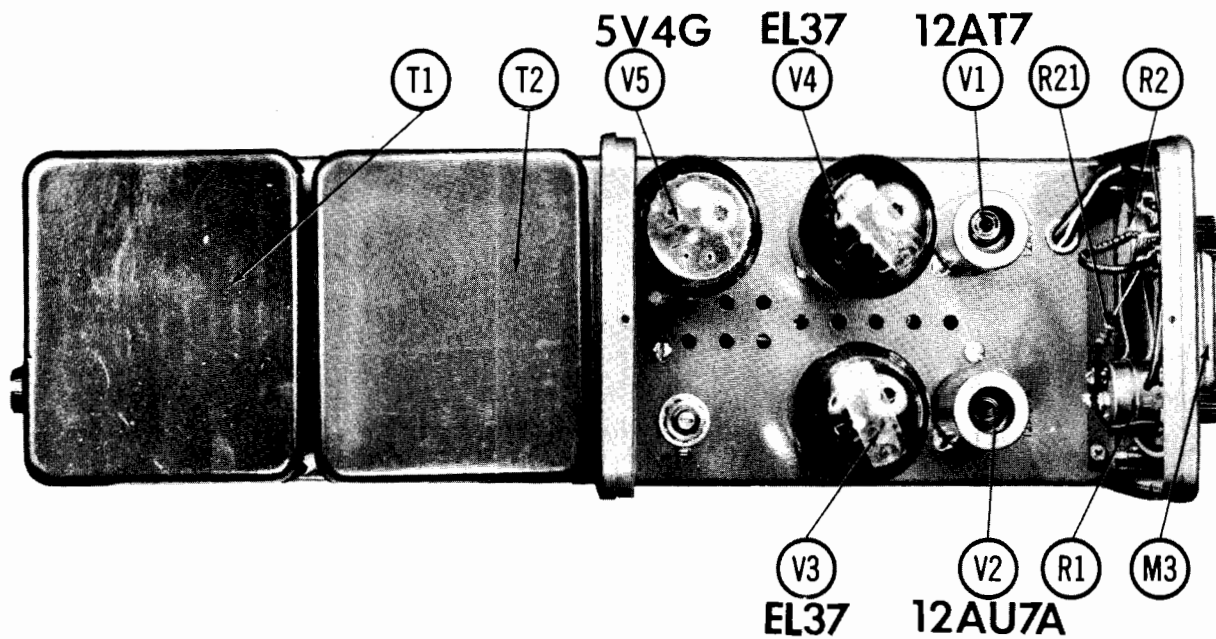
Note 1. Not used in some versions.

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA						INSTALLATION NOTES
	RESIST- ANCE	WATTS	FISHER PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.		
R1A	1000Ω	1	R557-128	AB-5	A47-1000-S	Q11-108	U4	Z-Matic	
B	Shart	1	Not Req.	AK-8	RS-3/16	NQ	D8-37	Attach to R1A	
C	Switch	1	Not Req.	KB-1	SWE-12	76-1	US-26	Attach to R1A	
R2A	100K	1	R557-121				U40	Peak Power	
B	Shart	1	Not Req.				D8-37	Attach to R2A	
R3A	500K	1	R-2815-9	AB-59	A47-500K-S	Q11-133	SU-50	Level	
B	Shart	1	Not Req.	AK-1	FXS-1/4	Not Req.	SU-35	Attach to R3A	
R4A	50K	1	R-5000K-5	AB-31	A47-50K-S	Q11-123	Not Req.	Balance	
B	Shart	1	Not Req.	AK-1	FXS-1/4	RQ		Attach to R4A	
R5	35K	1						Peak Power Indicator Note 1.	

Note 1. Not used in some versions.

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued) **RESISTORS**

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING OHMS	REPLACEMENT DATA		NOTES
		FISHER PART No.	IRC PART No.	
R6	1500Ω	RC-203F152K	BTS-1500	
R7	220K	RC-203F224K	BTS-220K	
R8	10K	RC-203F103K	BTS-10K	
R9	100K	RC-203F104K	BTS-100K	
R10	68K	RC-203F683K	BTS-68K	
R11	470K	RC-203F474K	BTS-470K	
R12	470K	RC-203F474K	BTS-470K	
R13	150K	RC-203F154K	BTS-150K	
R14	150K	RC-203F154K	BTS-150K	
R15	4700Ω	RC-203F472K	BTS-4700	
R16	470K	RC-203F474K	BTS-470K	
R17	470K	RC-203F474K	BTS-470K	
R18	68Ω	BTS-68		Note 1
R19	68Ω	BTS-68		Note 1

Note 1. Not used in some versions.

TRANSFORMER (POWER)

ITEM No.	RATING			REPLACEMENT DATA		
	PRI.	SEC. 1	SEC. 2	FISHER PART No.	Halldorson PART No.	Triad PART No.
T1	117VAC @ 1A	800VCT @ 3.2A	SEC. 3	T-557-123		

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA			NOTES
	PRI.	SEC.	FISHER PART No.	Halldorson PART No.	Triad PART No.	
T2	4300Ω CT	16Ω tap @ .94Ω	T-557-123			

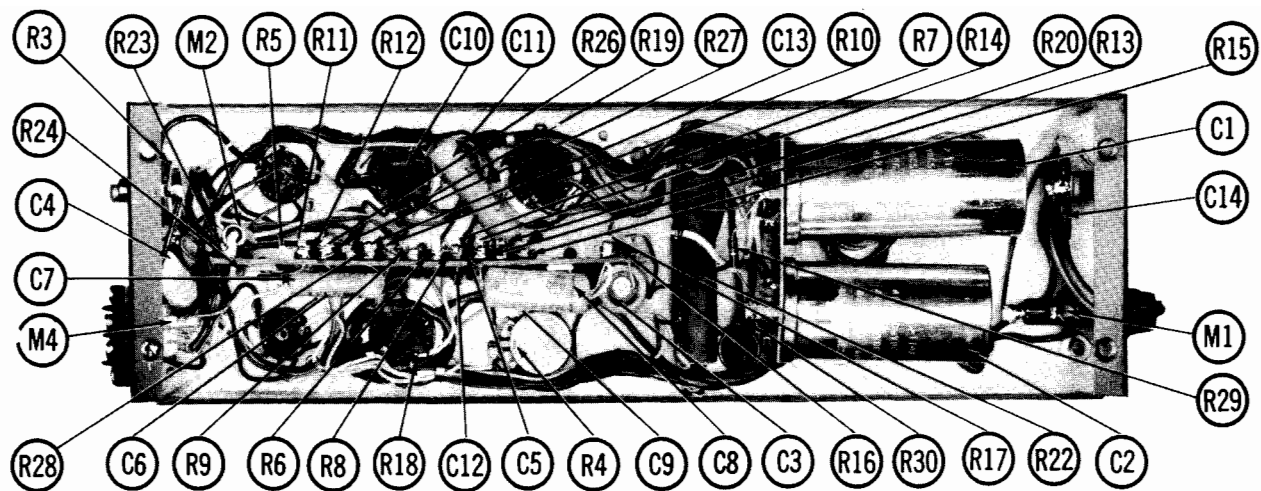
FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA		
			FISHER PART No.	LITTELFUSE PART No.	BUSS PART No.
M1	3AG	3A 250V	FUSE HOLDER	FUSE 312003 (SAG 3A)	FUSE AGC 3 HOLDER HRP

MISCELLANEOUS

ITEM No.	PART NAME	FISHER PART No.	NOTES
M2	Neon Bulb	V-NE-61	#NE51, Voltage Regulator
M3	Neon Bulb	I-557-120	Power Indicator
M4	Switch	S-505-117	Output Impedance Selector (DPDT-Slide Type)

CHASSIS—BOTTOM VIEW

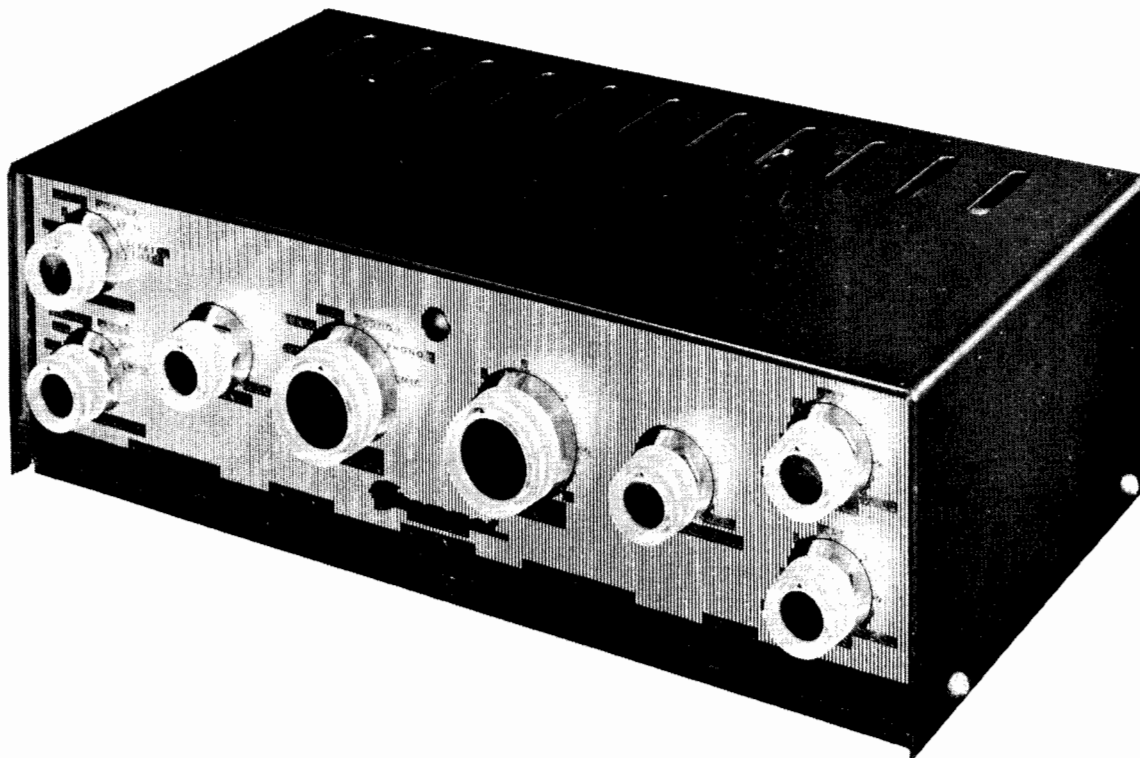


ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AV7	†240K	00	10000	.10	.10	†120K	†240K	100K	.10
V2	12AU6A	†160K	470K	47000	.10	.10	†160K	470K	47000	.10
V3	EL-37	NC	.10	2300	1700	470K	TP	.10	3700	
V4	EL-37	NC	.10	2200	1700	470K	TP	.10	3700	
V5	5V46	NC	33K	NC	950	NC	900	NC	33K	

1. DC voltage measurements taken with vacuum tube voltmeter;
2. AC voltages measured at 1000 ohms per volt.
3. Socket connections are shown at bottom views.
4. Measured values are from socket pin to common negative.
5. Line voltage maintained at 117 volts for voltage readings.
6. Nominal tolerance on component values makes possible a variation of $\pm 15\%$ in voltage and resistance readings.
7. All controls at minimum, proper output load connected.

0 SEE PARTS LIST FOR ALTERNATE
VALUE OR APPLICATION

A PHOTOFACT STANDARD NOTATION SCHEMATIC
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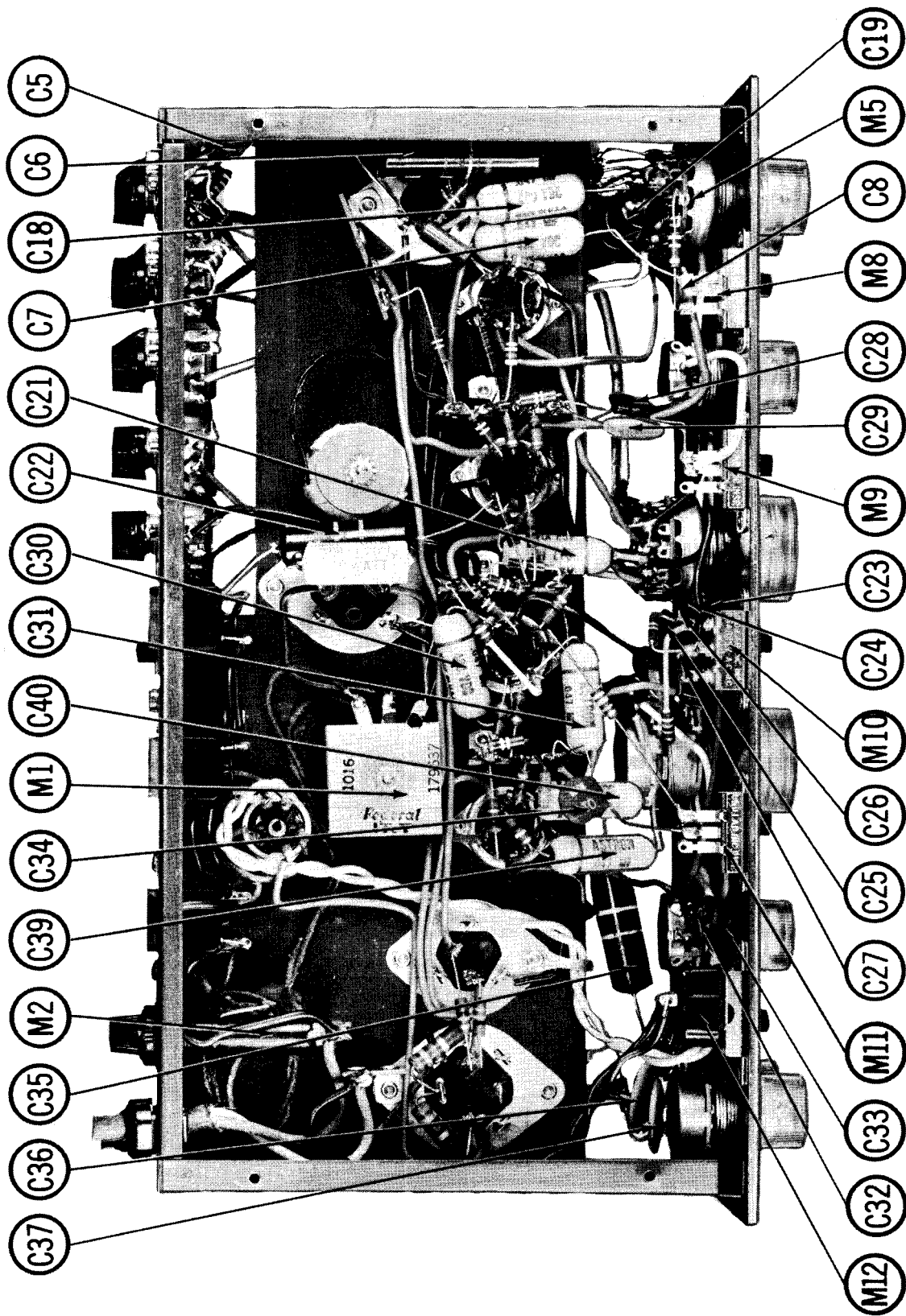
**GROMMES
MODEL 212**

TRADE NAME	Grommes Model 212		
MANUFACTURER	Precision Electronics, Inc., 9101 King Ave., Franklin Park, Ill.		
TYPE SET	AC Operated 8 Channel Preamplifier		
TUBES (Five)	Types 12AX7 Phono Preamplifier, 12AX7 AF Amp.-Cath. Follower, 12AX7 AF Amplifier, 12AX7 AF Amp.-Cath. Follower, 6X4 Rectifier		
POWER SUPPLY	110-120 Volts AC-60 Cycles	RATING	.25 Amp. @ 117 Volts AC (22 Watts)

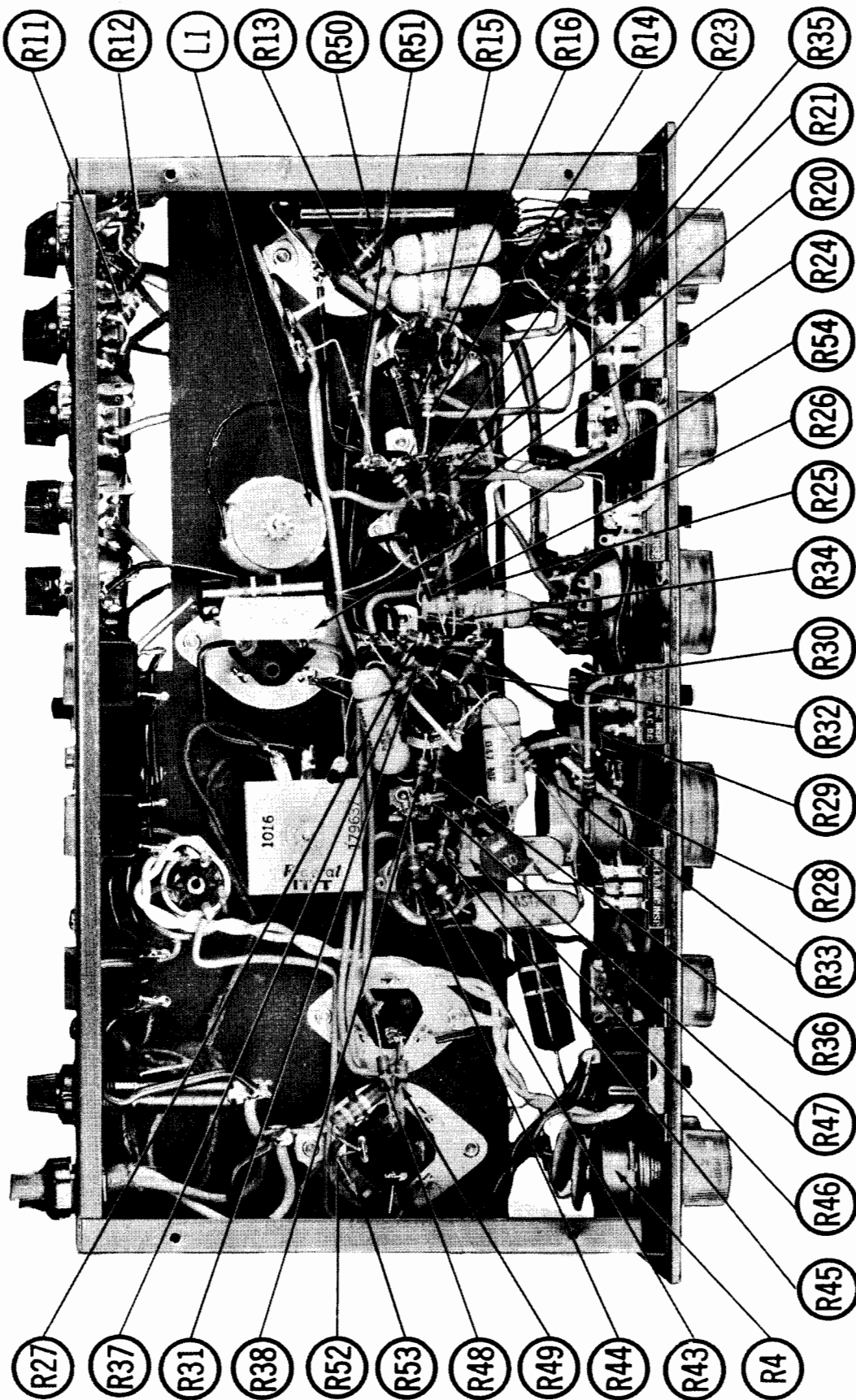
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CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION



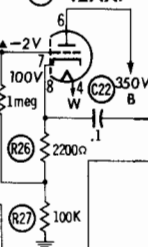
CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

SELECTOR SW M6 SHOWN
IN AUX POSITION
SW SEQUENCE:

1. AUX
2. TUNER
3. TAPE
4. PHONO#1 (MAG)
5. PHONO#2
6. MIC

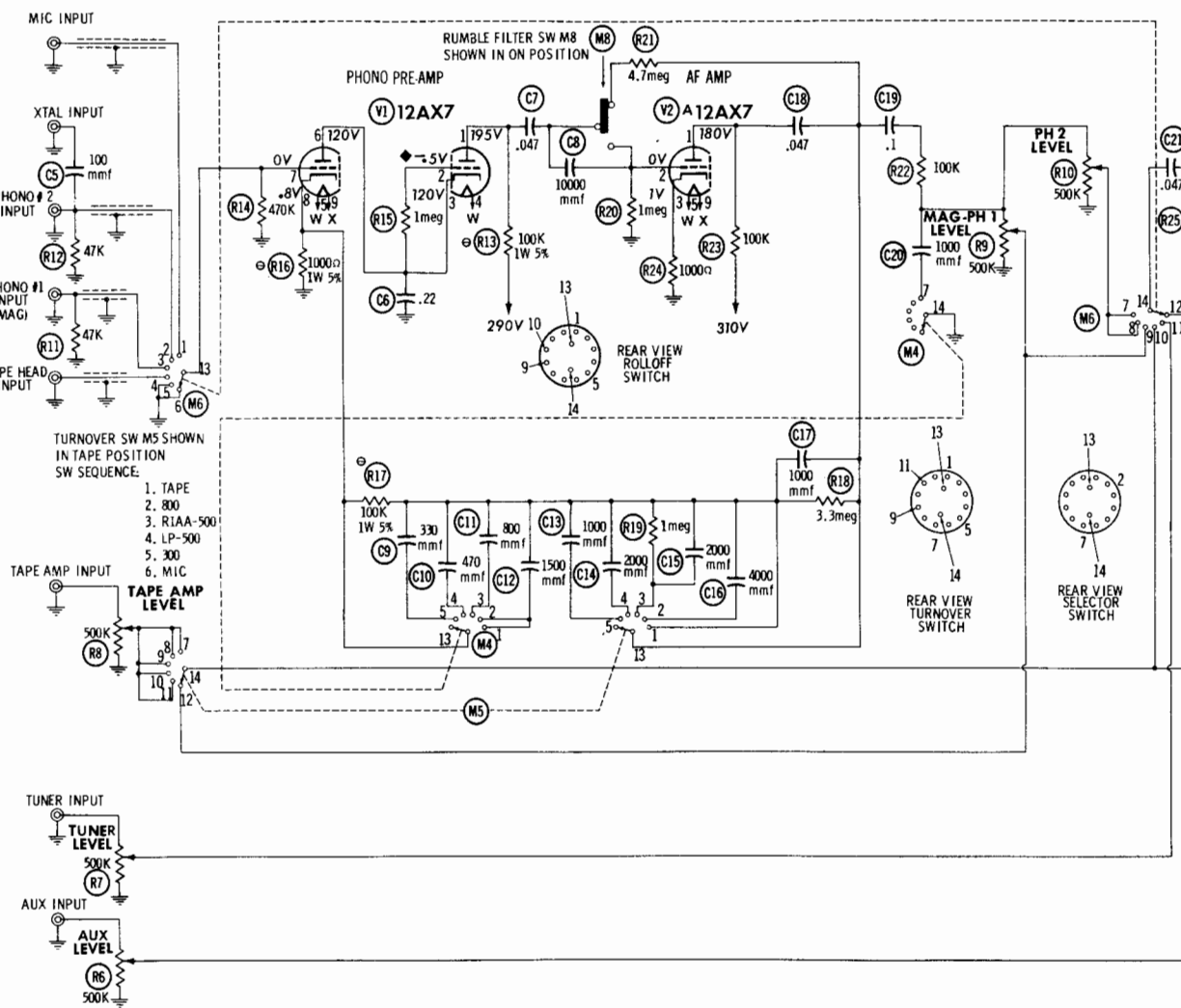
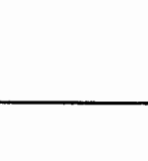
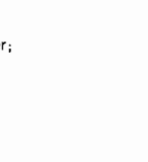
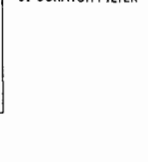
CATHODE FOLLOWER

V2 B 12AX7



ROLLOFF SW M4 SHOWN
IN TAPE POSITION
SW SEQUENCE:

1. TAPE
2. 6
3. 10.5-12
4. R1AA
5. LP-16
6. SCRATCH FILTER



RESISTANCE READINGS

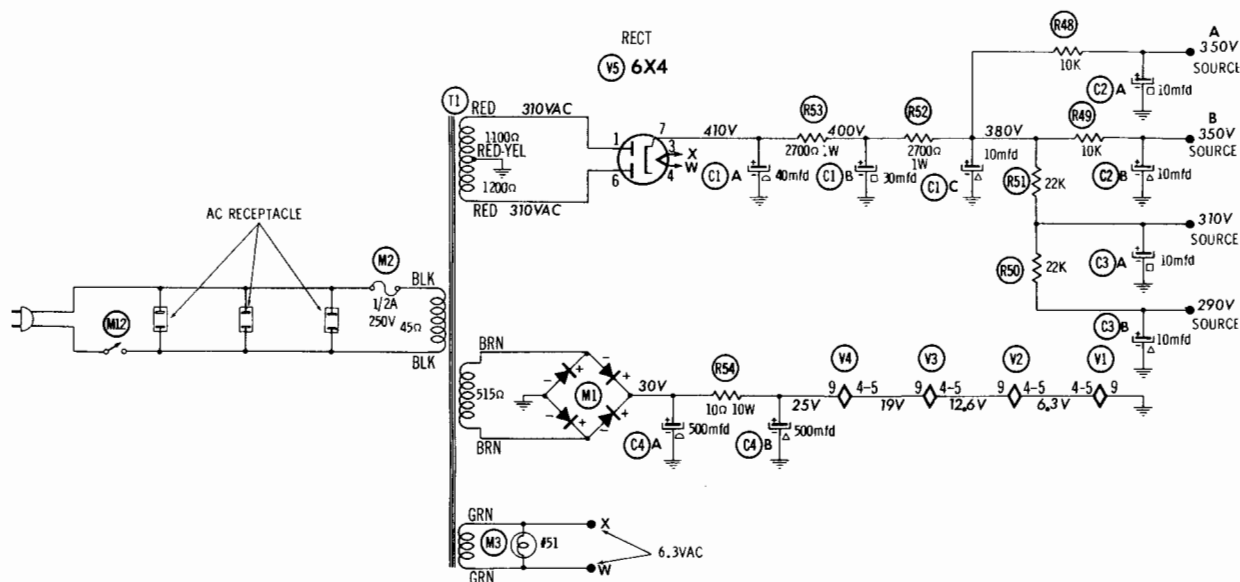
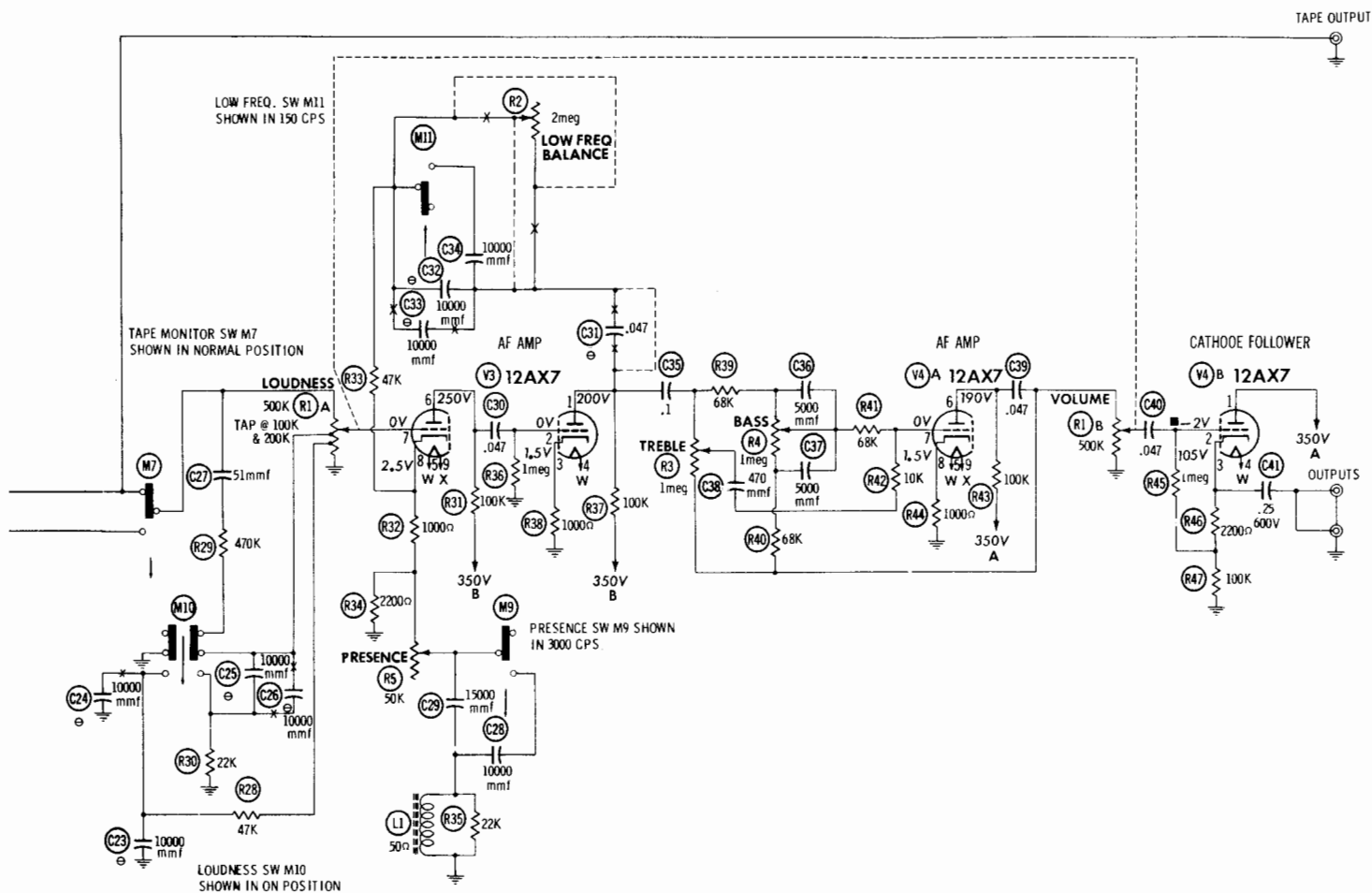
ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7	† 147K	INF	INF	3Ω	3Ω	INF	0Ω	1000Ω	0Ω
V2	12AX7	† 127K	1Meg	1000Ω	3Ω	3Ω	† 15K	1Meg	100K	6Ω
V3	12AX7	† 115K	1Meg	1000Ω	6Ω	6Ω	† 115K	0Ω	3200Ω	9Ω
V4	12AX7	† 15K	1.1Meg	100K	9Ω	9Ω	† 115K	480K	1000Ω	12Ω
V5	6X4	1100Ω	NC	INF	INF	NC	1200Ω	20K(Min)		

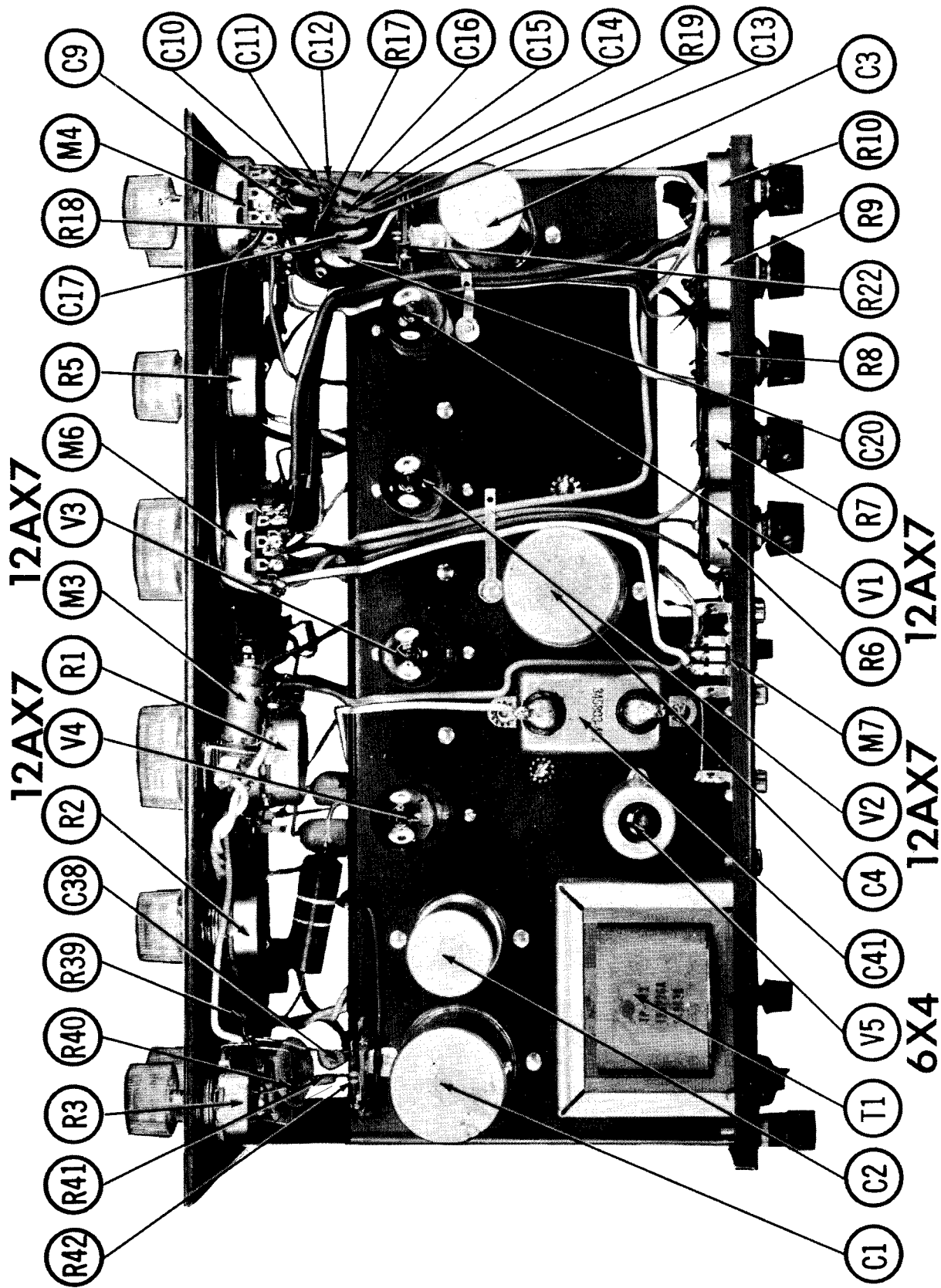
ALL MEASUREMENTS TAKEN IN "TAPE" POSITION
 • MEASURED FROM PIN 3 OF V1
 ■ MEASURED FROM PIN 3 OF V4

† MEASURED FROM PIN 7 OF V5
 ▲ MEASURED FROM PIN 8 OF V2
 NC NO CONNECTION

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ± 1% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

SEE PARTS LIST FOR ALTERNATE
VALUE OR APPLICATION





CHASSIS TOP VIEW

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Phono Pre-amplifier	12AX7	
V2	AF Amp. - Cath. Follower	12AX7	
V3	AF Amplifier	12AX7	
V4	AF Amp. - Cath. Follower	12AX7	
V5	Rectifier	6X4	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING				REPLACEMENT DATA			
	CAP.	VOLT.	GROMMES PART No.	AEROVOX PART No.	CORNEILL-DUBIER PART No.	MALLOY PART No.	SPRAGUE PART No.	NOTES
C1A	.40	400		AFH4-117-48	B0420			
C1B	.30	350			BR1045			
C2A	.10	350		AFH2-47	B0370			
C3A	.10	350		AFH2-47	B0370			
C4A	.500	25			BR5002			
C5	.4500	25			TC2505			
C6	.4500	25						
C7	.4500	25						
C8	.4500	25						
C9	.4500	25						
C10	.4500	25						
C11	.4500	25						
C12	.4500	25						
C13	.4500	25						
C14	.4500	25						
C15	.4500	25						
C16	.4500	25						
C17	.4500	25						
C18	.4500	25						
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C28	.4500	25						
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C30	.4500	25						
C31	.4500	25						
C32	.4500	25						
C33	.4500	25						
C34	.4500	25						
C35	.4500	25						
C36	.4500	25						
C37	.4500	25						
C38	.4500	25						
C39	.4500	25						
C40	.4500	25						
C41	.4500	25						

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA				NOTES
	CAP.	VOLT.	GROMMES PART No.	AEROVOX PART No.	CORNEILL-DUBIER PART No.	MALLOY PART No.	
C5	.100	200		1468-0001	D8-101		
C6	.22	200		P288N-22	DF-503		
C7	.047	400		BPD-05	DD-103		
C8	.00000			BPD-01	DD-331		
C9	.330			BPD-00033	DD-471		
C10	.470			BPD-00047	DD-471		
C11	.800			BPD-0008	DD-801		
C12	.1500			BPD-0015	DD-152		
C13	.1000			BPD-0010	DD-102		
C14	.2000			BPD-0020	DD-202		
C15	.2000			BPD-0020	DD-202		
C16	.4000			BPD-0040	DD-402		
C17	.1000			BPD-0010	DD-102		
C18	.047	400		BPD-05	DF-503		
C19	.1	400		P488N-1	DD-104		
C20	.047	400		BPD-001	DD-102		
C21	.047	400		BPD-05	DF-503		
C22	.1	400		P488N-1	DD-104		
C23	.10000			BPD-01	DD-103		
C24	.10000			BPD-01	DD-103		
C25	.10000			BPD-01	DD-103		
C26	.10000			BPD-01	DD-103		
C27	.51			SI 51	DD-103		
C28	.10000			BPD-01	DD-103		
C29	.10000			BPD-015	DD-103		
C30	.047	400		BPD-05	DF-503		
C31	.047	400		BPD-05	DF-503		
C32	.10000			BPD-01	DD-103		
C33	.10000			BPD-01	DD-103		
C34	.10000			BPD-01	DD-103		
C35	.1	400		P488N-1	DD-104		
C36	.005			BPD-005	DD-502		
C37	.5000			BPD-005	DD-502		
C38	.470			BPD-00047	DD-471		
C39	.047	400		BPD-05	DF-503		
C40	.047	400		BPD-05	DF-503		
C41	.25	800		BPD-05	DF-603		

① When C23 is 20000MMF C24 is not used.
② When C25 is 20000MMF C26 is not used.
③ Not used in some versions.

PARTS LIST AND DESCRIPTIONS (Continued)

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESIST-ANCE	WATTS	GROMMES PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLOY PART No.	
R1A	500K	1/2W	LC2X500K	B-76	A47-2Meg-Z	Q18-133XX		Loudness, Tap@ 100K & 200K
R2A	500K	2Meg	LFBC2M	Not Req.	RS-2	Q13-139	U55	Volume
R3A	1Meg	1/2W	GTC-1M	B-69	A47-1Meg-S	Q11-137	Not Req.	Low Freq. Bal.
R4A	1Meg	1/2W	GTC-1M	B-69	RS-2	Not Req.	U64	Treble
R5A	50K	1/2W	PC50K	Not Req.	A47-1Meg-S	Q11-137	Not Req.	Bass
R6A	500K	1/2W	VC500K	B-34	RS-2	Not Req.	U54	Presence
R7A	500K	1/2W	VC500K	Not Req.	A47-75K-V	Q14-123	Not Req.	Input Level AUX.
R8A	500K	1/2W	VC500K	B-60	A47-500K-Z	Q13-133	Not Req.	Input Level Tuner
R9A	500K	1/2W	VC500K	Not Req.	RS-2	Q13-133	Not Req.	Input Level Tape Amp.
R10A	500K	1/2W	VC500K	B-60	A47-500K-Z	Q13-133	Not Req.	Input Level Mag. Phono #1
	500K	1/2W	VC500K	Not Req.	RS-2	Q13-133	Not Req.	Input Level Phono #2
	500K	1/2W	VC500K	B-60	A47-500K-Z	Q13-133	Not Req.	

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA				NOTES
	OHMS	WATT	GROMMES PART No.	IRC PART No.	ITEM No.	RATING	
R1	47K			BTS-47K	R33	47K	BTS-47K
R2	47K			BTS-47K	R34	22000	BTS-2200
R3	100K	5%		BTS-100K	R35	22K	BTS-22K
R4	100K	5%		BTS-100K	R36	100K	BTS-100K
R5	100K	5%		BTS-100K	R37	100K	BTS-100K
R6	100K	5%		BTS-100K	R38	10000	BTS-10000
R7	100K	5%		BTS-100K	R39	68K	BTS-68K
R8	100K	5%		BTS-100K	R40	68K	BTS-68K
R9	100K	5%		BTS-100K	R41	68K	BTS-68K
R10	100K	5%		BTS-100K	R42	100K	BTS-100K
R11	100K	5%		BTS-100K	R43	100K	BTS-100K
R12	100K	5%		BTS-100K	R44	10000	BTS-10000
R13	100K	5%		BTS-100K	R45	10000	BTS-10000
R14	100K	5%		BTS-100K	R46	100K	BTS-100K
R15	100K	5%		BTS-100K	R47	100K	BTS-100K
R16	100K	5%		BTS-100K	R48	10K	BTS-10K
R17	100K	5%		BTS-100K	R49	10K	BTS-10K
R18	100K	5%		BTS-100K	R50	22K	BTS-22K
R19	100K	5%		BTS-100K	R51	22K	BTS-22K
R20	100K	5%		BTS-100K	R52	27000	BTS-27000
R21	100K	5%		BTS-100K	R53	27000	BTS-27000
R22	100K	5%		BTS-100K	R54	100	PW10-10

Note 1. Low noise deposited carbon resistor.

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA			
	PH.	SEC. 1	SEC. 2	SEC. 3	GROMMES PART No.	Merit PART No.	Thorderson PART No.	Trid PART No.
T1	117VAC	640VCT	8.3VAC	23VAC	TP-212			

PARTS LIST AND DESCRIPTIONS (Continued)

COILS

ITEM No.	USE	REPLACEMENT DATA				NOTES
		GROMMES PART No.	WEISSNER PART No.	MERIT PART No.	MILLER PART No.	
L1	Tone Choke					220 Millihenries

SELENIUM RECTIFIER

ITEM No.	RATING CURRENT (Measured)	REPLACEMENT DATA			NOTES
		GROMMES PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	
M1	.3A		1017	CIB	604B

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA				
			GROMMES PART No.	HOLDER	FUSE	LITTELFUSE PART No.	BUSS PART No.
M2	3AG	$\frac{1}{2}$ A 250V			312, 500 (3AG $\frac{1}{2}$ A 250V)	342001	AGC $\frac{1}{2}$
							HOLDER
							HKP

MISCELLANEOUS

ITEM No.	PART NAME	GROMMES PART No.	NOTES
M3	Pilot Lamp		#51
M4	Switch		Roll-off DB (Rotary Wafer Type)
M5	Switch		Turnover CPS (Rotary Wafer Type)
M6	Switch		Input Selector (Rotary Wafer Type)
M7	Switch		Tape Monitor (Slide Type SPDT)
M8	Switch		Rumble Filter (Slide Type SPDT)
M9	Switch		Presence (Slide Type SPDT)
M10	Switch		Loudness (Slide Type DPST)
M11	Switch		Low Freq. (Slide Type SPDT)
M12	Switch		Power On-Off (Slide Type SPDT)



GROMMES
MODELS 221

TRADE NAME	Grommes Model 221		
MANUFACTURER	Precision Electronics, Inc. 9101 King Ave., Franklin Park, Ill.		
TYPE SET	AC Operated Audio Amplifier		
TUBES (Five)	Types 12AU7 AF Amplifier, 12AU7 AF Amp. - Phase Inv., (2) 6L6GB (or) 5881 Output, 5U4GB Rectifier		
POWER SUPPLY	110-120 Volts AC - 60 Cycles	RATING	.9 Amp. @ 117 Volts AC (9 Watts)

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PARTS LIST AND DESCRIPTIONS
TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	AF Amplifier	12AU7	
V2	AF Amp. - Phase Inv.	12AU7	
V3	Output	6L6GB	Note 1

ITEM No.	USE	TYPE	NOTES
V4	Output	6L6GB	
V5	Rectifier	5U4GB	

Note 1. Some versions may use type 5881

ELECTROLYTIC CAPACITORS

ITEM No.	CAP.	RATING VOLT.	REPLACEMENT DATA				
			GROMMES PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.
C1A	.40	450		AFH3-50-05	C0372	FP396.1	TMQ-12
C1B	.20	450					Q-040
C2	4.20	450					TD-10-250
C3	50	50		PRS350V10 PRS50V50	BR1045 BR505	TC52 TC39	MT-4510 MT-0550

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	CAP.	RATING VOLT	REPLACEMENT DATA					NOTES
			GROMMES PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	
C4	.22	200		P268N-22	DD-251	CUB2P22	ED-250	2TM-P22
C5	.250	200		BPD-00025		LIOT25		UC-5325
C6	.22	200		P268N-22		CUB2P22		GEM-2022
C7	.1	400		P488N-1	DF-104	CUB4P1		GEM-401
C8	.1	400		P488N-1	DF-104	CUB4P1		4TM-P1
C9	.20	400		NFO-SI 20	D6-200	LIQ22	ED-20	4TM-P1

CONTROLS

ITEM No.	RESIST. ANCE	RATING WATTS	REPLACEMENT DATA				INSTALLATION NOTES
			GROMMES PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	
R1A	500K	1/2		B-80	A47-500K-Z	Q13-133	Gain
R2A	10K	4		Not Req.	RS-2	Not Req.	Damping (Wire Wound)
R2B	10K	4					Damping (Wire Wound)

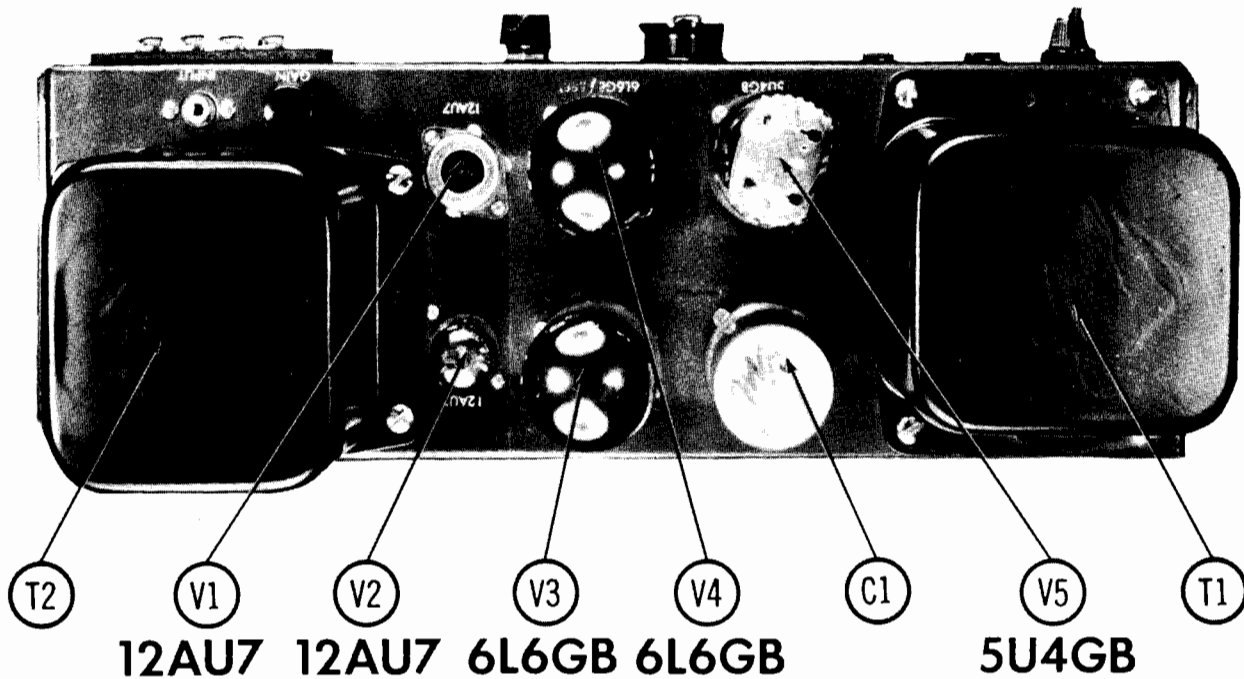
RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING OHMS	WATT	REPLACEMENT DATA		NOTES
			GROMMES PART No.	IRC PART No.	
R3	1Meg				
R4	22K				
R5	100K	1			
R6	100K				
R7	1000Ω				
R8	22K				
R9	2200Ω				
R10	1Meg	1			
R11	47K				

ITEM No.	RATING OHMS	WATT	REPLACEMENT DATA		NOTES
			GROMMES PART No.	IRC PART No.	
R12	56K				
R13	22K	1			
R14	1000Ω	2			
R15	100K				
R16	1000Ω				
R17	100K	10			
R18	400Ω				
R19	22K	2			
R20	22K	1			
R21	10K				

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA			
	PRI.	SEC. 1	SEC. 2	SEC. 3	GROMMES PART No.	Stancor PART No.	Merit PART No.	Thorderson PART No.
T1	117VAC @ .8A	780VCT @ .10A	5VAC @ 3A	6.3VCT @ 2.5A	TP8UA			25R08
	① Drill new mounting holes.							BSM-207 ①

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	REPLACEMENT DATA				NOTES
	IMPEDANCE	GROMMES PART No.	Stancor PART No.	Thorderson PART No.	
T2	6800Ω CT	T022	A-3102	22S39	① Drill new mounting holes.
	16Ω Tap			BSM-186 ①	
	80, 4Ω				

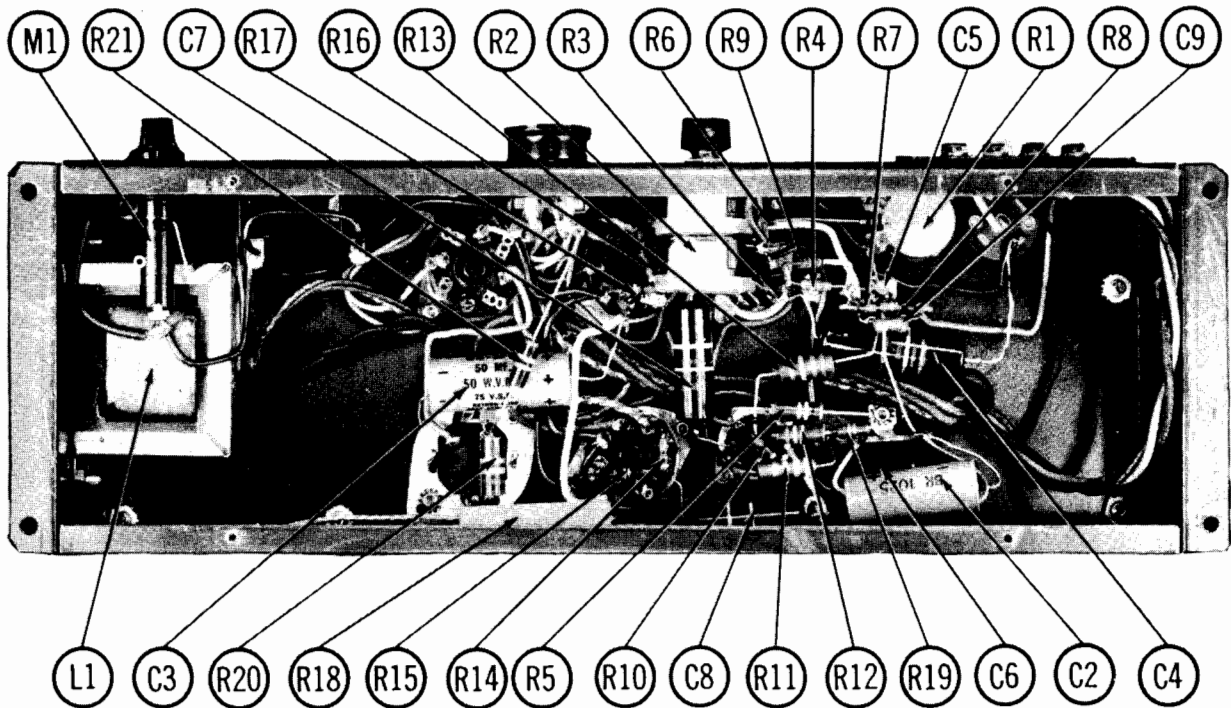
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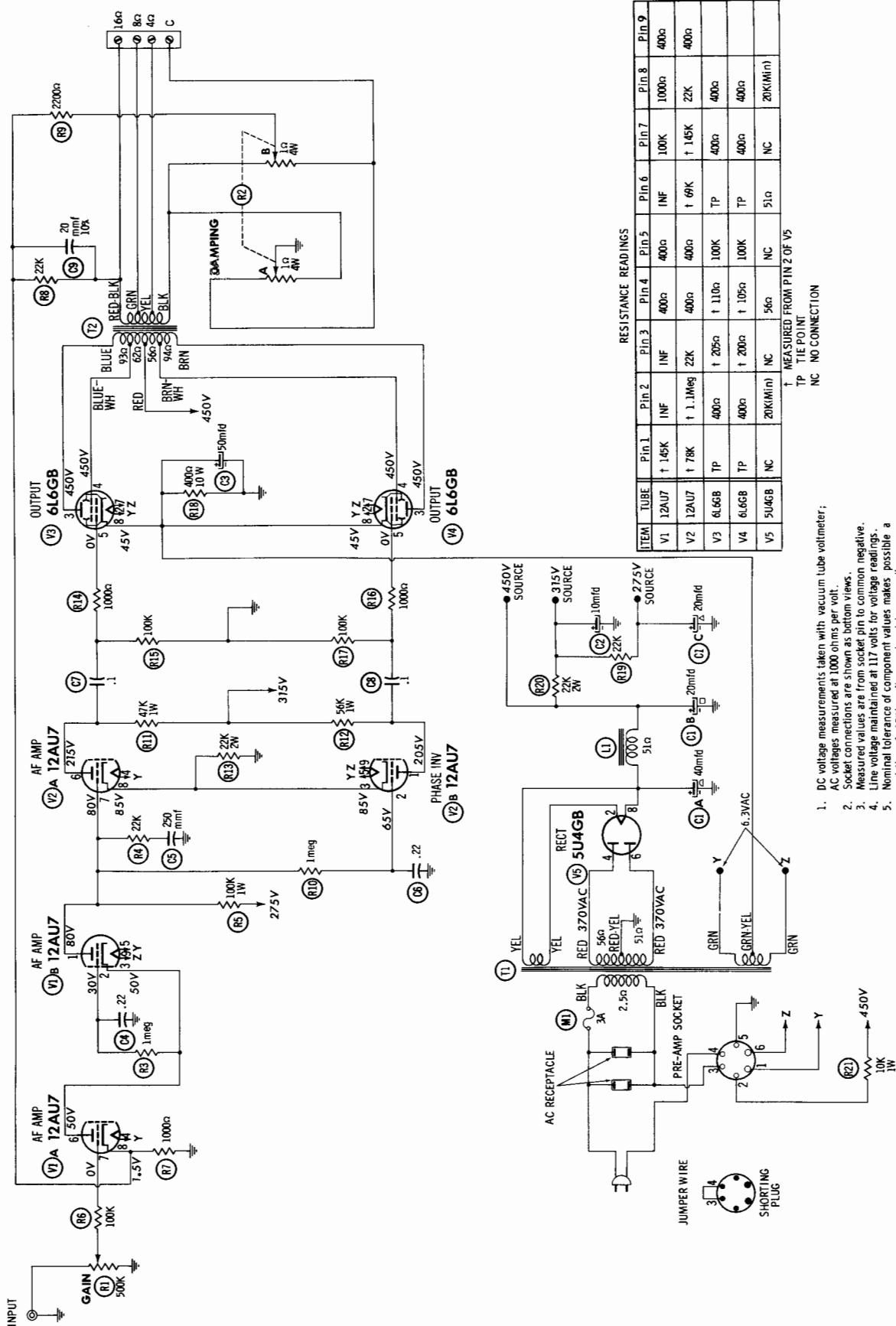
ITEM No.	RATINGS				REPLACEMENT DATA			
	TOTAL D.C. CURRENT	D. C. RESISTANCE	INDUCTANCE (1000 μH)		GROMMES PART No.	Stancor PART No.	Merit PART No.	Thorderson PART No.
L1	.110A	5Ω	2H		CH2	C5026	C-2874	28C43
								C-2304
								C-23X

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA			
			GROMMES PART No.	FUSE	HOLDER	BUSS PART No.
M1	3AG	3A		312003 (3AG-3A)	342001	HCM
					AGC3	

CHASSIS—BOTTOM VIEW





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HAMILTON
MODEL PMX-6

TRADE NAME	Hamilton Model PMX-6	
MANUFACTURER	Hamilton Electronics Corp., 2726 W. Pratt Ave., Chicago 45, Ill.	
TYPE SET	AC Operated 6 Channel Preamplifier Mixer	
TUBES (Three)	Types 12AX7 Channels 1-2 Preamplifier, 12AX7 Channels 3-4 Preamplifier, 12AX7 Channels 5-6 Preamplifier	
POWER SUPPLY	110-120 Volts AC - 60 Cycles	RATING .04 Amp. @ 117 Volts AC (5 Watts)

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PARTS LIST AND DESCRIPTIONS
TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES	ITEM No.	USE	TYPE	NOTES
V1	Channel 1-2 Preamp	12AX7		V3	Channel 5-6 Preamp.	12AX7	
V2	Channel 3-4 Preamp.	12AX7					

ELECTROLYTIC CAPACITORS

RATING		REPLACEMENT DATA					
ITEM No.	CAP. VOLT.	HAMILTON PART No.	AEROVOX PART No.	CORNELL-DUBIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.
C1A	440	(Note 1)	AFH3-09	CO080	FP31L 4	TMT -8	T-040
B	150						
C	20						

Note 1: Some versions may use 20-20-20MFD unit in this application.

FIXED CAPACITORS

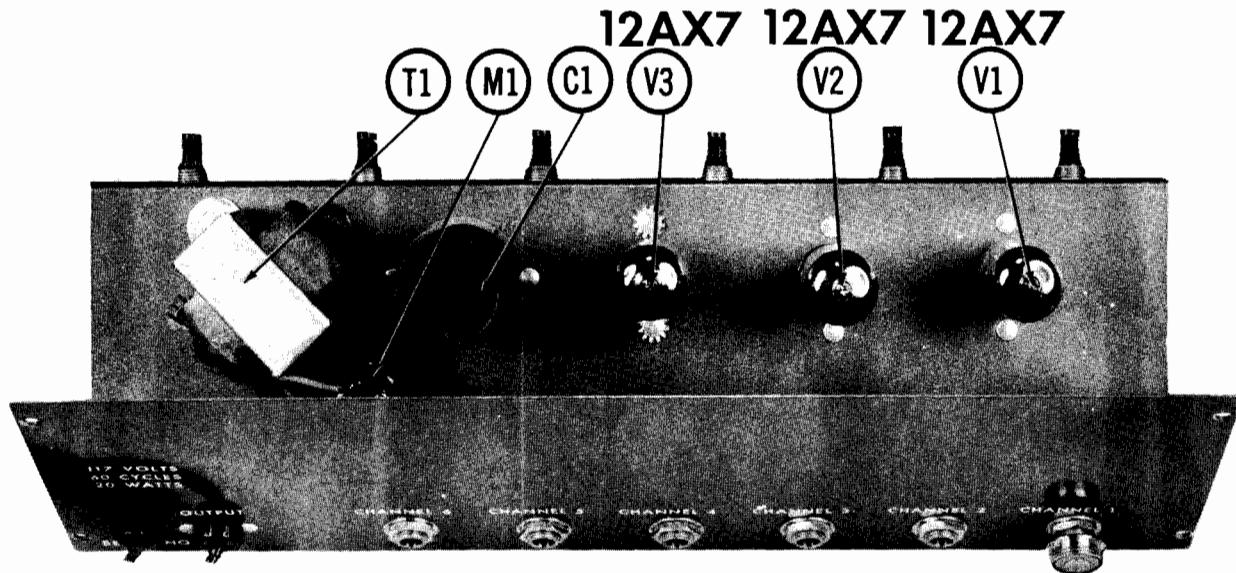
Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

RATING		REPLACEMENT DATA					
ITEM No.	CAP. VOLT.	HAMILTON PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBIER PART No.	ERIE PART No.	MALLORY PART No.
C2	10000		BPD-01	DD-103	BYA68S1	ED-01	DC511
C3	10000		BPD-01	DD-103	BYA68S1	ED-01	DC511
C4	10000		BPD-01	DD-103	BYA68S1	ED-01	DC511
C5	10000		BPD-01	DD-103	BYA68S1	ED-01	DC511
C6	10000		BPD-01	DD-103	BYA68S1	ED-01	DC511
C7	10000		BPD-01	DD-103	BYA68S1	ED-01	DC511

CONTROLS

RATING		REPLACEMENT DATA				INSTALLATION NOTES	
ITEM No.	RESIST-ANCE	WATTS	HAMILTON PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.
R1A	500K	1		B-80	A47-500K-Z	Q13-133	U48
B	500K	1		Not Req.	K88-3	Not Req.	Not Req.
R2A	500K	1		B-80	A47-500K-Z	Q13-133	U48
B	500K	1		Not Req.	K88-3	Not Req.	Not Req.
R3A	500K	1		B-80	A47-500K-Z	Q13-133	U48
B	500K	1		Not Req.	K88-3	Not Req.	Not Req.
R4A	500K	1		B-80	A47-500K-Z	Q13-133	U48
B	500K	1		Not Req.	K88-3	Not Req.	Not Req.
R5A	500K	1		B-80	A47-500K-Z	Q13-133	U48
B	500K	1		Not Req.	K88-3	Not Req.	Not Req.
R6A	500K	1		B-80	A47-500K-Z	Q13-133	U48
B	500K	1		Not Req.	K88-3	Not Req.	Not Req.
C	Switch			XB-1	SWE-12	78-1	US-26

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING			REPLACEMENT DATA		NOTES
	OHMS	WATT		HAMILTON PART No.	IRC PART No.	
R7	470K					
R8	100K					
R9	150K					
R10	470K					
R11	100K					
R12	150K					
R13	470K					
R14	100K					
R15	150K					
R16	470K					
R17	100K					
R18	150K					
R19	470K					
R20	100K					
R21	150K					
R22	470K					
R23	100K					
R24	150K					
R25	33K					
R26	33K					
R27	10K					

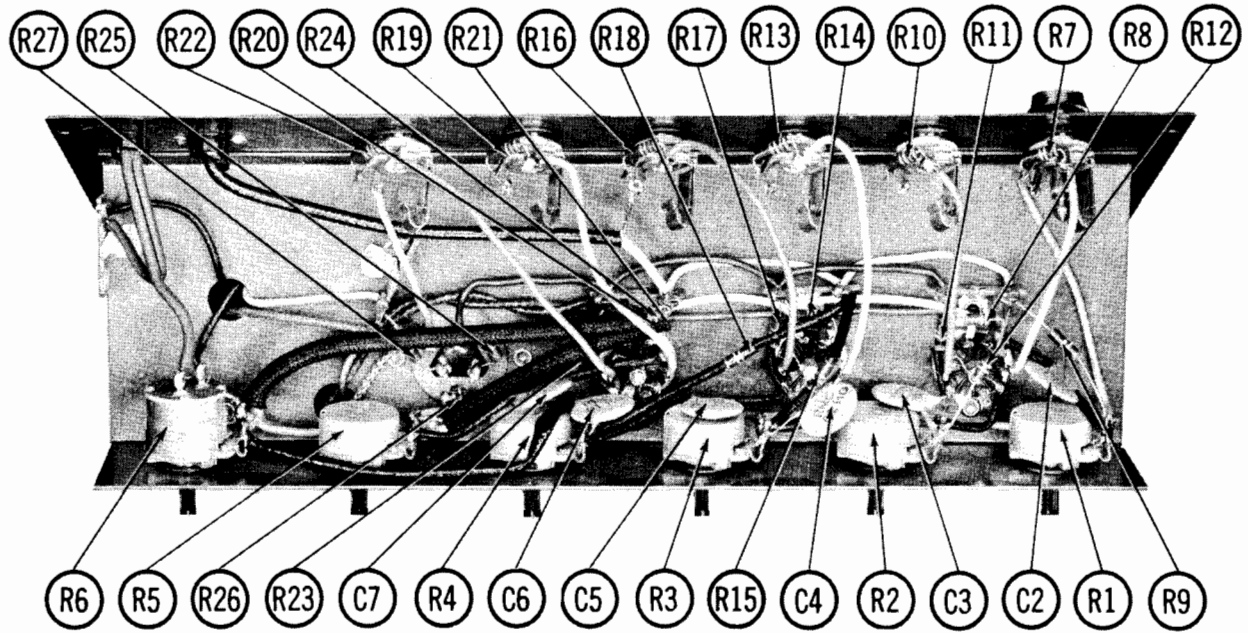
TRANSFORMER (POWER)

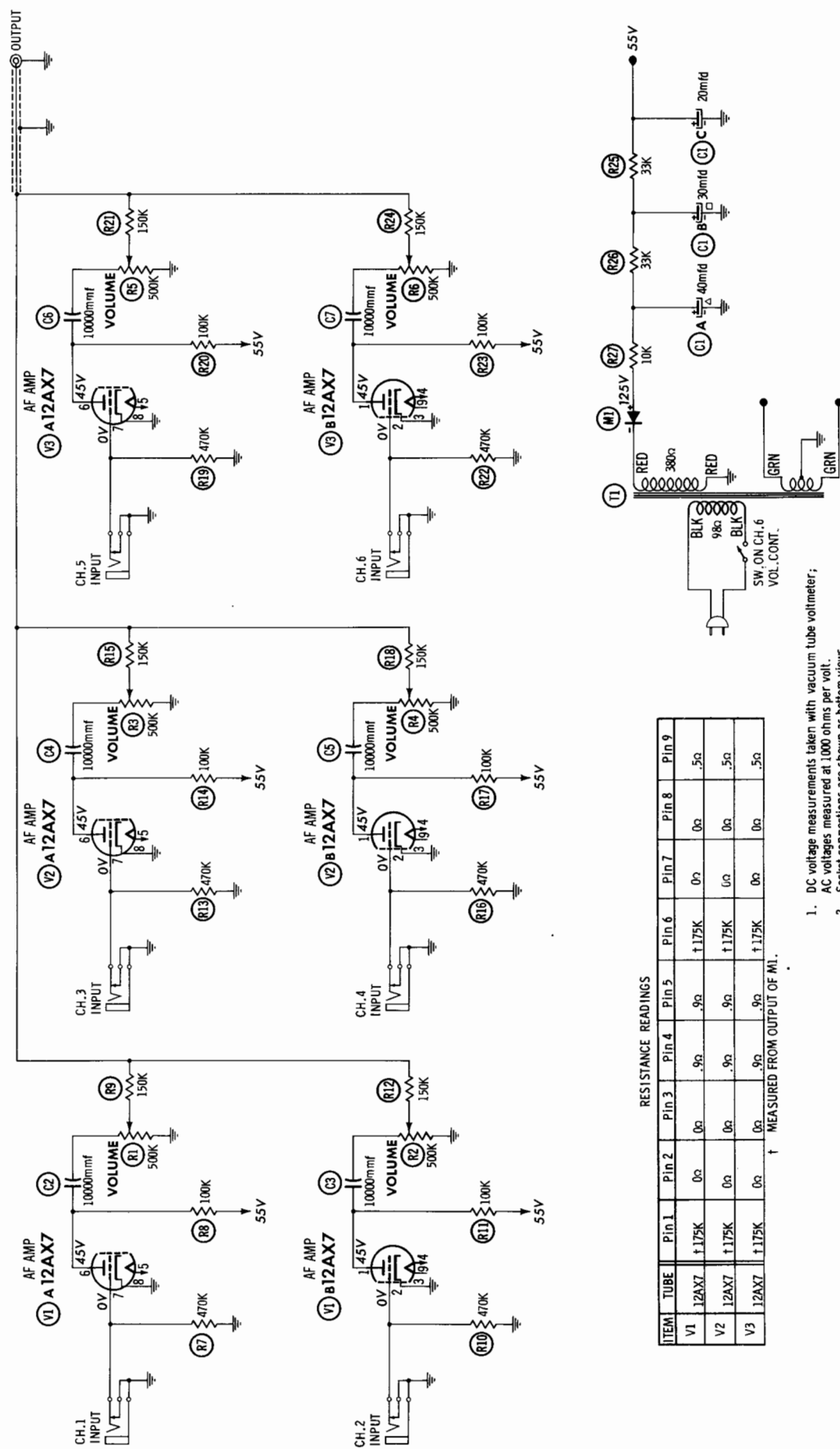
ITEM No.	RATING				REPLACEMENT DATA			
	PR.	SEC. 1	SEC. 2	SEC. 3	HAMILTON PART No.	Hollidson PART No.	Merit PART No.	Thordorson PART No.
T1	117VAC ② .04A	150VAC ② .0012A	8VCT ② .34A		33GA07		P-3046	26R32

SELENIUM RECTIFIER

ITEM No.	RATING		REPLACEMENT DATA				NOTES
	CURRENT (measured)		HAMILTON PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	MALLORY PART No.	
M1	.0012A			1386	R8050	8S75	50

CHASSIS—BOTTOM VIEW





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1. DC voltage measurements taken with vacuum tube voltmeter;
2. AC voltages measured at 1000 ohms per volt.
3. Socket connections are shown as bottom views.
4. Measured values are from socket pin to common negative.
5. Line voltage maintained at 117 volts for voltage readings.
6. Nominal tolerance of component values makes possible a variation of $\pm 1\%$ in voltage and resistance readings.
7. All controls at minimum, proper output load connected.



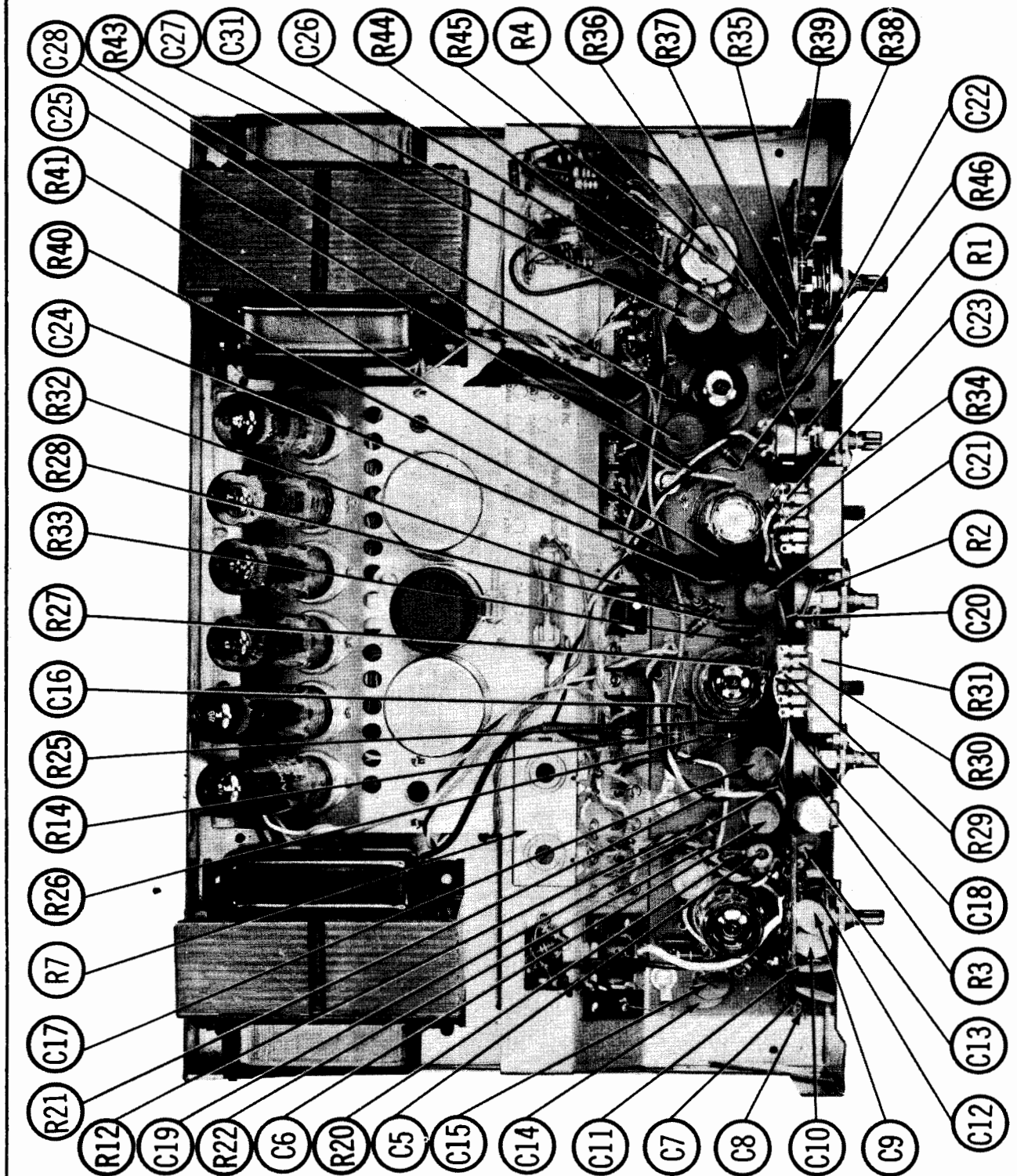
HARMAN-KARDON
MODEL A-1040 "Trend II"

TRADE NAME	Harman-Kardon Model A-1040 "Trend II"	
MANUFACTURER	Harman-Kardon, Inc., 520 Main St., Westbury, L.I., N. Y.	
TYPE SET	AC Operated 6 Channel 40 Watt Audio Amplifier	
TUBES (Ten)	Types 12AX7 Phono Preamplifier, 12AX7 Cath. Follower-AF Amp., 12AV6 AF Amplifier, 12AT7 AF Amp-Phase Inv., (4) 12AB5 Output, (2) EZ81 Rectifier	
POWER SUPPLY	105-125 Volts AC-60 Cycles	RATING .83 Amp. @117 Volts AC (84 Watts)

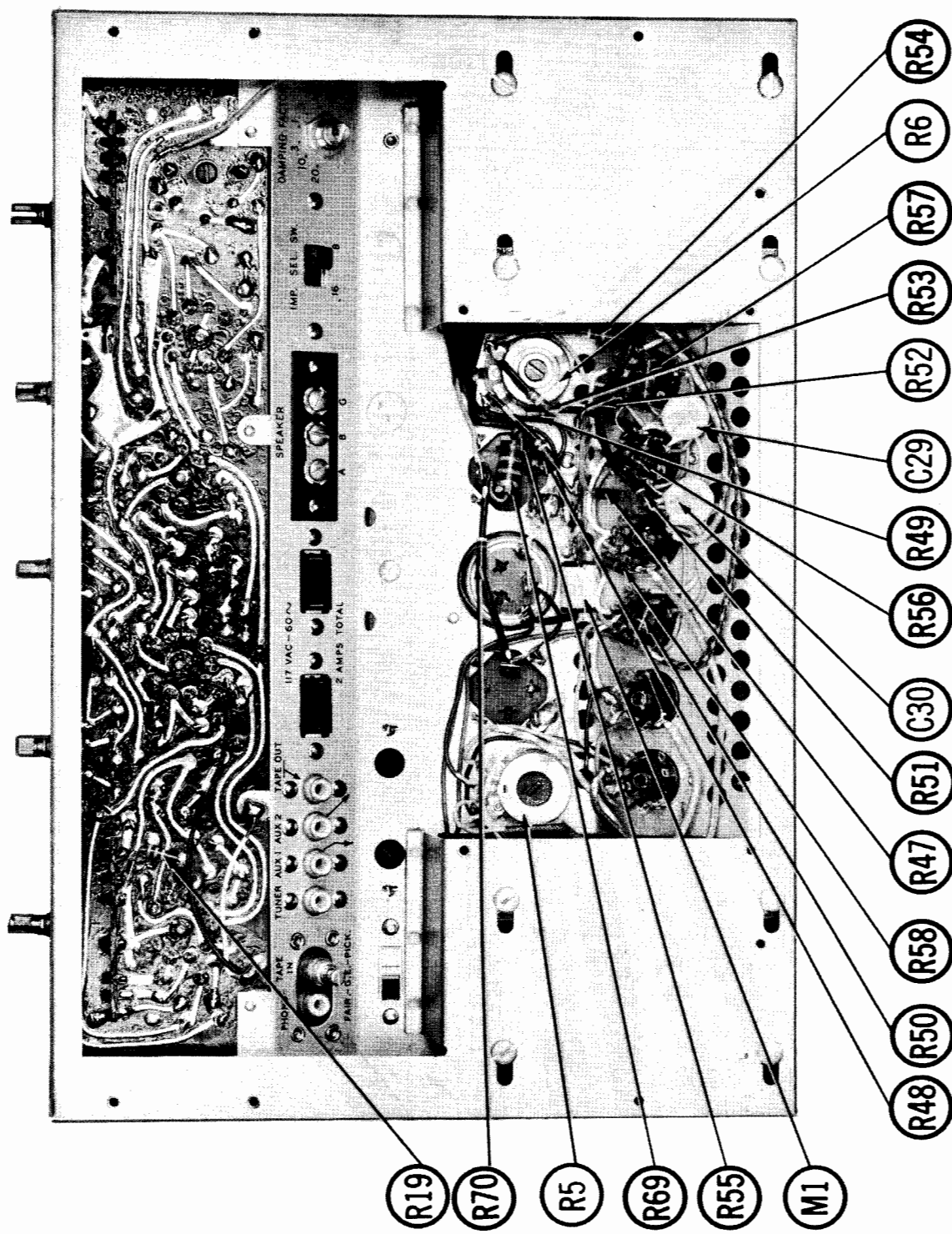
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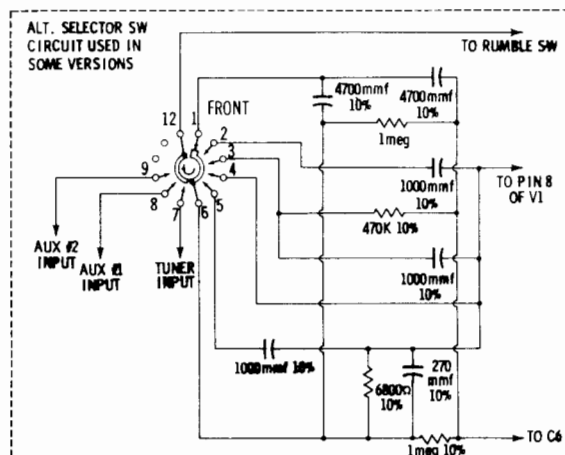
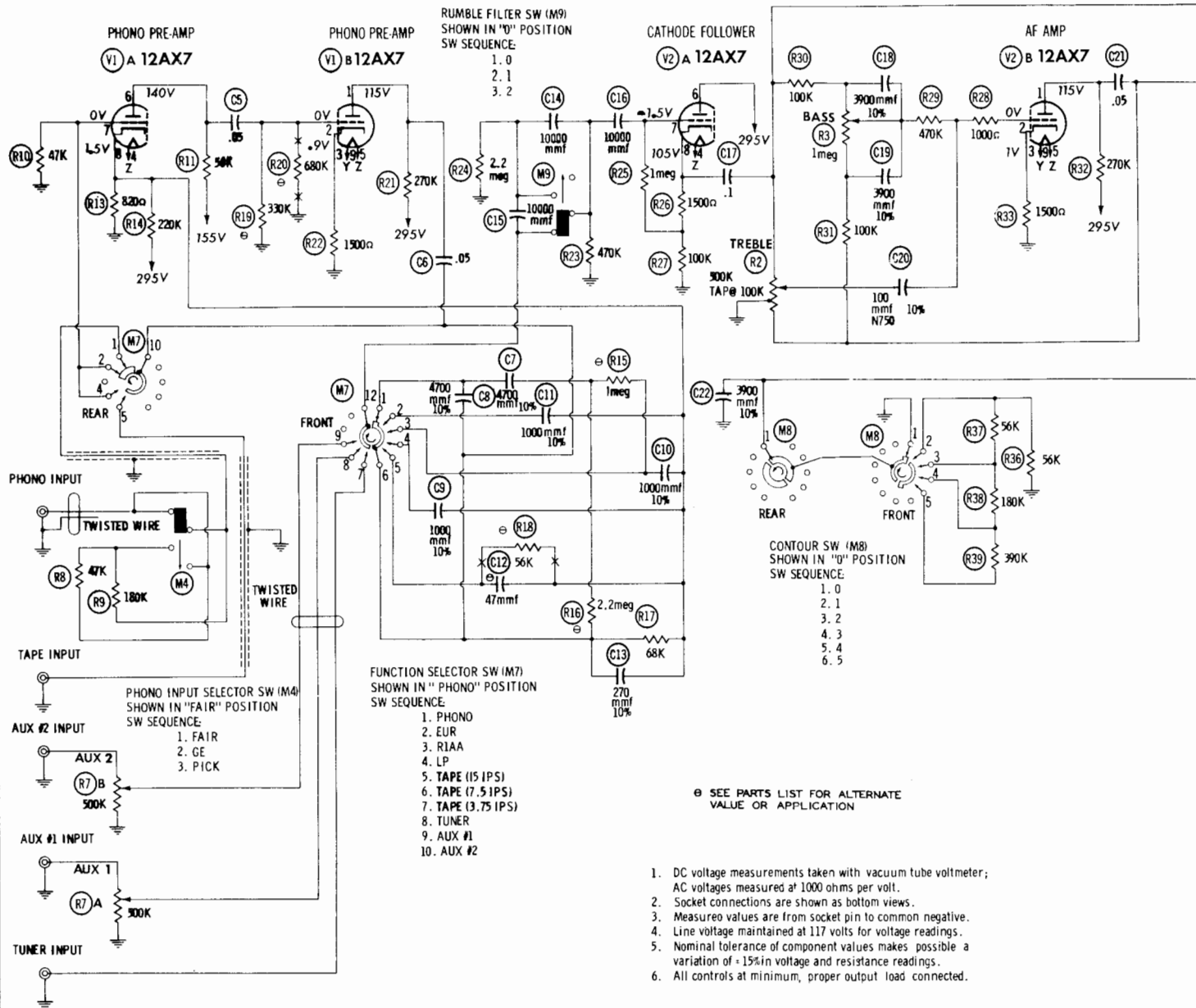
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CHASSIS TOP VIEW



CHASSIS BOTTOM VIEW



RESISTANCE READINGS

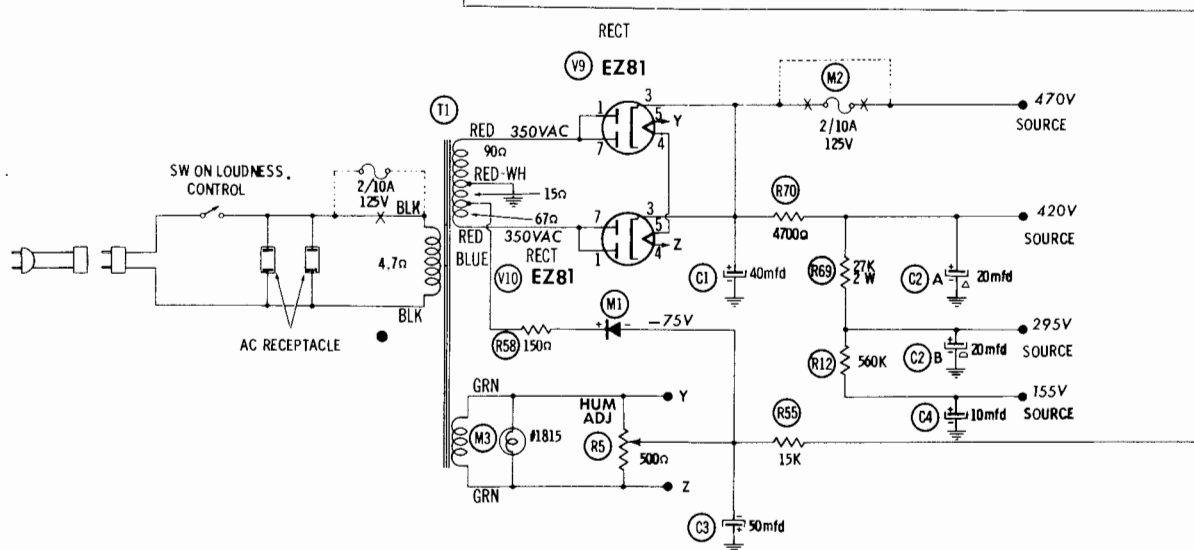
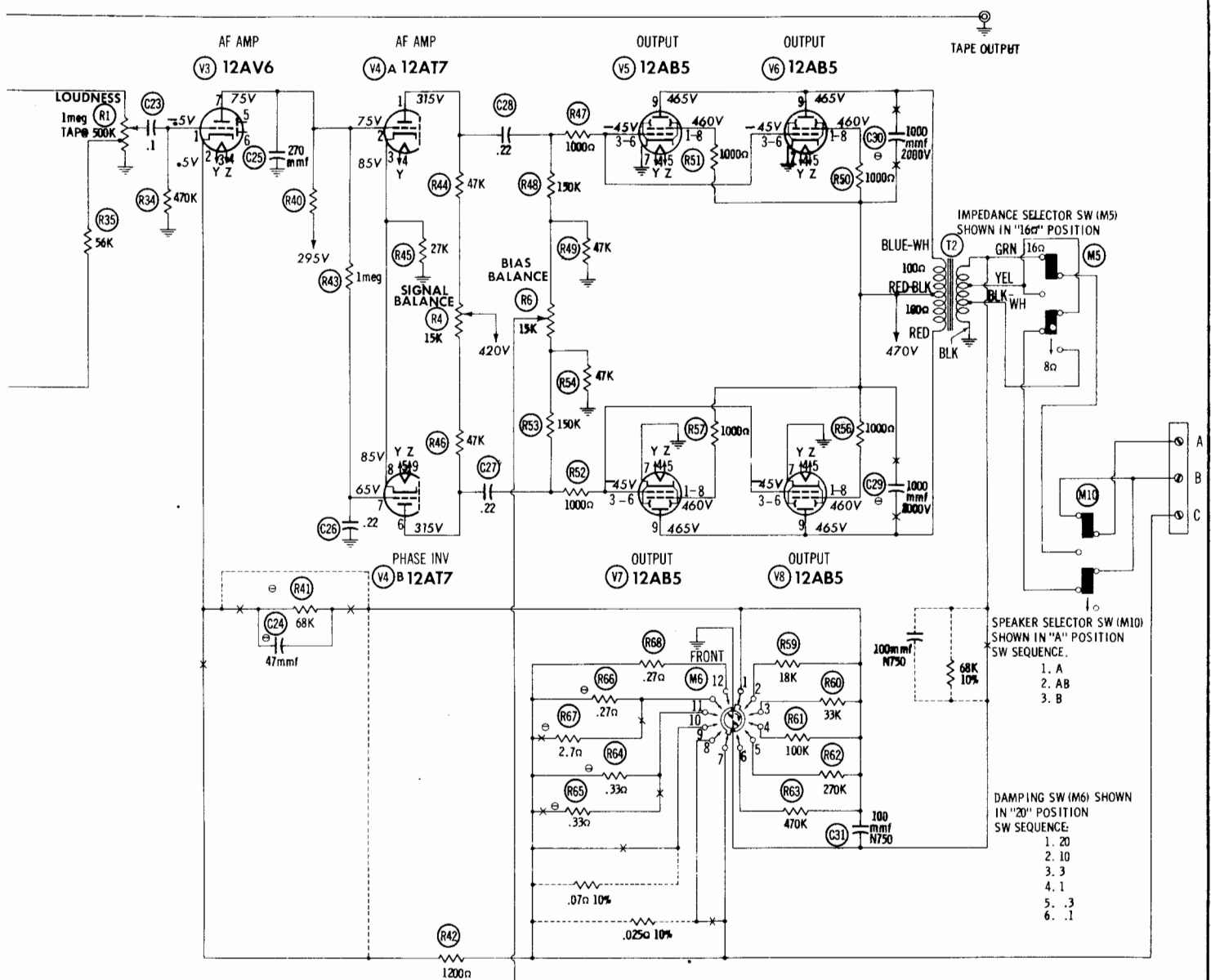
ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7	† 300K	220K	1500Ω	37K	37K	† 270K	47K	820Ω	37K
V2	12AX7	† 300K	600K	1500Ω	37K	37K	† 32K	1.1meg	100K	37K
V3	12AV6	470K	1100Ω	37K	37K	NC	NC	† 500K		
V4	12AT7	† 60K	† 500K	27K	37K	37K	† 60K	† 1.5meg	27K	37K
V5	12AB5	† 1000Ω	TP	165K	37K	37K	165K	0Ω	† 1000Ω	† 100Ω
V6	12AB5	† 1000Ω	TP	165K	37K	37K	165K	0Ω	† 1000Ω	† 100Ω
V7	12AB5	† 1000Ω	TP	165K	37K	37K	165K	0Ω	† 1000Ω	† 100Ω
V8	12AB5	† 1000Ω	TP	165K	37K	37K	165K	0Ω	† 1000Ω	† 100Ω
V9	EZ81	90Ω	NC	20K(min)	37K	37K	NC	90Ω	NC	NC
V10	EZ81	81Ω	NC	20K(min)	37K	37K	NC	81Ω	NC	NC

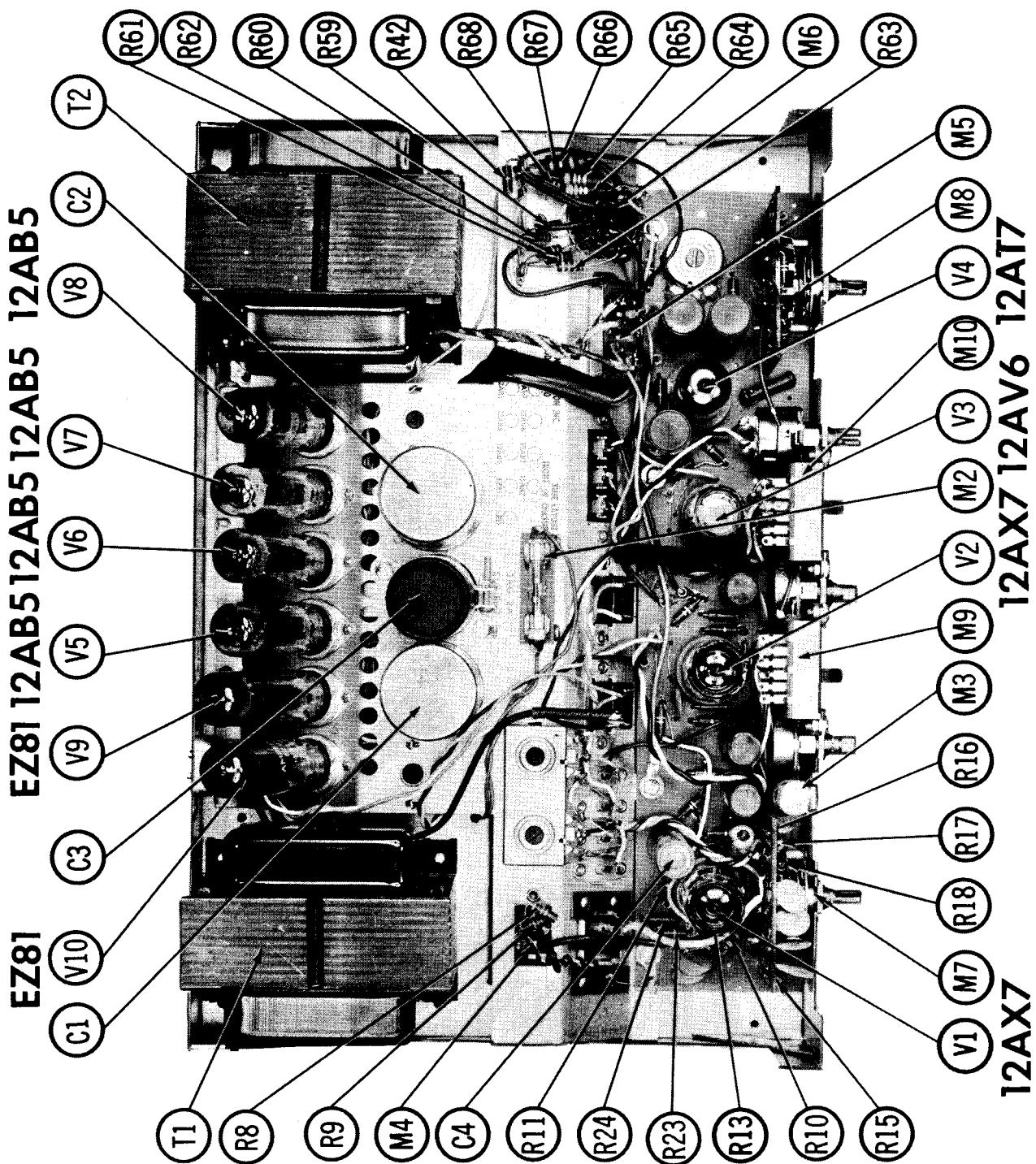
† MEASURED FROM PIN 3 OF V10

• MEASURED FROM PIN 8 OF V2

NC NO CONNECTION

TP TIE POINT





PARTS LIST AND DESCRIPTIONS TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Phono Preamplifier	12AX7	
V2	Cath. Follower-AF Amp.	12AX7	
V3	AF Amplifier	12AV6	
V4	AF Amplifier-Phase Inv.	12AT7	
V5	Output	12AB5	

ELECTROLYTIC CAPACITORS

ITEM No.	CAP.	RATING	REPLACEMENT DATA			
			HARMAN-KARDON PART No.	CORNELL-DUBIER PART No.	AEROVOX PART No.	SPRAGUE PART No.
C1	40	475	JE1071739	A0518	AFH1-58-10	
C2A	20	475	JE1071740	B0500	AFH2-59	
C3	20	475			AFH1-18	
C4	10	150	JE1021711	A0200	PR5150V10	

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	CAP.	RATING	REPLACEMENT DATA				NOTES
			HARMAN-KARDON PART No.	CORNELL-DUBIER PART No.	CENTRALAB PART No.	SPRAGUE PART No.	
C5	.05	200		CUB285	DF-503	GEM-415	
C6	.05	400		BC6847J		ACE615	
C7	4700	400		IR5D47		MS-247	10%
C8	4700	400		IR5D47		MS-247	10%
C9	1000	1000		IR5D1	ED-1000	MCB255	10%
C10	1000	1000		IR5D1	ED-1000	MS-21	10%
C11	1000	1000		IR5D1	ED-1000	MS-21	10%
C12	47	47		L10Q47	ED-47	UC-5447	10%
C13	270	270		5R5T27	ED-270	DCS11	10%
C14	10000	10000		BYA681	ED-01	5HK-81	10%
C15	10000	10000		BYA681	ED-01	5HK-81	10%
C16	10000	10000		BYA681	ED-01	5HK-81	10%
C17	1	200		BC2P1J	ED-01	2SE-P10	10%
C18	3900	3900		IR5D39	MS-239	MS-239	10%
C19	3900	3900		TCN-100	NT-531	5TCU-T1	10%
C20	100	400		BC6847J	ACE615	MS-239	10%
C21	.05	400		IR5D39	MS-239	MS-239	10%
C22	3900	3900		BC2P1J	UC-5447	UC-5447	10%
C23	47	200		L10Q47	UC-5447	UC-5447	10%
C24	270	400		BC6847J	UC-5447	UC-5447	10%
C25	22	400		L10Q47	UC-5447	UC-5447	10%
C26	22	400		BC6847J	UC-5447	UC-5447	10%
C27	22	400		BC6847J	UC-5447	UC-5447	10%
C28	1000	2000		BC6847J	UC-5447	UC-5447	10%
C29	1000	2000		BC6847J	UC-5447	UC-5447	10%
C30	1000	2000		BC6847J	UC-5447	UC-5447	10%
C31	100	2000		BC6847J	UC-5447	UC-5447	10%

① Not Used in Some Versions

CONTROLS

ITEM No.	RESIST.	RATING	REPLACEMENT DATA				INSTALLATION NOTES
			HARMAN-KARDON PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	MALLORY PART No.	
R1A	Imeg	Switch	RV1021836				Loudness, Tap @ 500K
R2	500K		RV1021834				Power On-Off
R3	Imeg		RV1021835				Treble, Tap @ 100K
R4	15K		RV1021725				Bass
R5A	500K		RV1021709				Signal Balance
R6A	15K		RV1021708				Hum Adjustment
R7A	500K		RV1021756				Bias Balance
C	500K						Aux. 1
							Aux. 2
							* Two Required

PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING	HARMAN-KARDON PART No.	NOTES	HARMAN-KARDON PART No.	NOTES
R8	47K				
R9	180K				
R10	47K				
R11	56K				
R12	580K				
R13	820K				
R14	220K				
R15	Imeg				
R16	2.2meg				
R17	68K				
R18	56K				
R19	330K				
R20	680K				
R21	270K				
R22	1500K				
R23	470K				
R24	2.2meg				
R25	Imeg				
R26	1500K				
R27	100K				
R28	1000K				
R29	470K				
R30	100K				
R31	100K				
R32	270K				
R33	1500K				
R34	470K				
R35	56K				
R36	56K				
R37	56K				
R38	180K				
R39	390K				

Note 1. Some versions may use 470K in this application
Note 2. Some versions may use Imeg in this application
Note 3. Not used in some versions
Note 4. Some versions may use 220K in this application
Note 5. Some versions may use 0.16K in this application
Note 6. Some versions may use 0.24K in this application

TRANSFORMER (POWER)

ITEM No.	RATING	HARMAN-KARDON PART No.	REPLACEMENT DATA	HARMAN-KARDON PART No.	REPLACEMENT DATA
T1	117V @ .85A 720VCT @ .074A 12V Tap @ 2.6A 85V @ 65V @ .002A	FT1071729			

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE	HARMAN-KARDON PART No.	REPLACEMENT DATA	HARMAN-KARDON PART No.	REPLACEMENT DATA	NOTES
T2	4400K CT	FT1071730				① Use Or-18, Shields Do Not Use 250K, 500K Taps

PARTS LIST AND DESCRIPTIONS (Continued)

RECTIFIERS

ITEM No.	RATING CURRENT (Measured)	REPLACEMENT DATA			NOTES
		Harman-Kardon PART No.	FEDERAL PART No.	SARKES TARZIAN PART No.	
M1	.002A	21021726	1159	CR20	10

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA			
			Harman-Kardon PART No.	LITTELFUSE PART No.	BUSS PART No.	
M2	3AG	2/10A 125V S/B	FUSE	FUSE	FUSE	HOLDER
			HOLDER	HOLDER	MDL 2/10	4405

MISCELLANEOUS

ITEM No.	PART NAME	Harman-Kardon PART No.	NOTES
M3	Pilot Lamp	#1815	Pair -GE-Pick (Slide Type SPDT)
M4	Switch	KE107141	Impedance Selector (Slide Type SPST)
M5	Switch	ER371057	Damping Factor (Rotary Wafar Type)
M6	Switch	ER102193	Function (Rotary Wafar Type)
M7	Switch	ER102193	Contour (Rotary Wafar Type)
M8	Switch	ER102193	Rumble Filter (Slide Type DPST)
M9	Switch	ES1021717	Speaker (Slide Type DPST)

WIRING DATA

General-use Unshielded Hook-up Wire	Use BELDEN No. 8530 (Solid) Available in Ten Colors
Power Cord	8524 (Stranded) Available in Ten Colors
Low-Loss Shielded Lead (Interconnecting)	Use BELDEN No. 1765-B (6 Ft. Length)
Phono Pick-up Arm Cable	1725-K (7 1/2 Ft. Length)
	Use BELDEN No. 8401
	Use BELDEN No. 8430 (Two Conductor - Twisted)

ADJUSTMENTS

BIAS BALANCE ADJUSTMENT (R6)

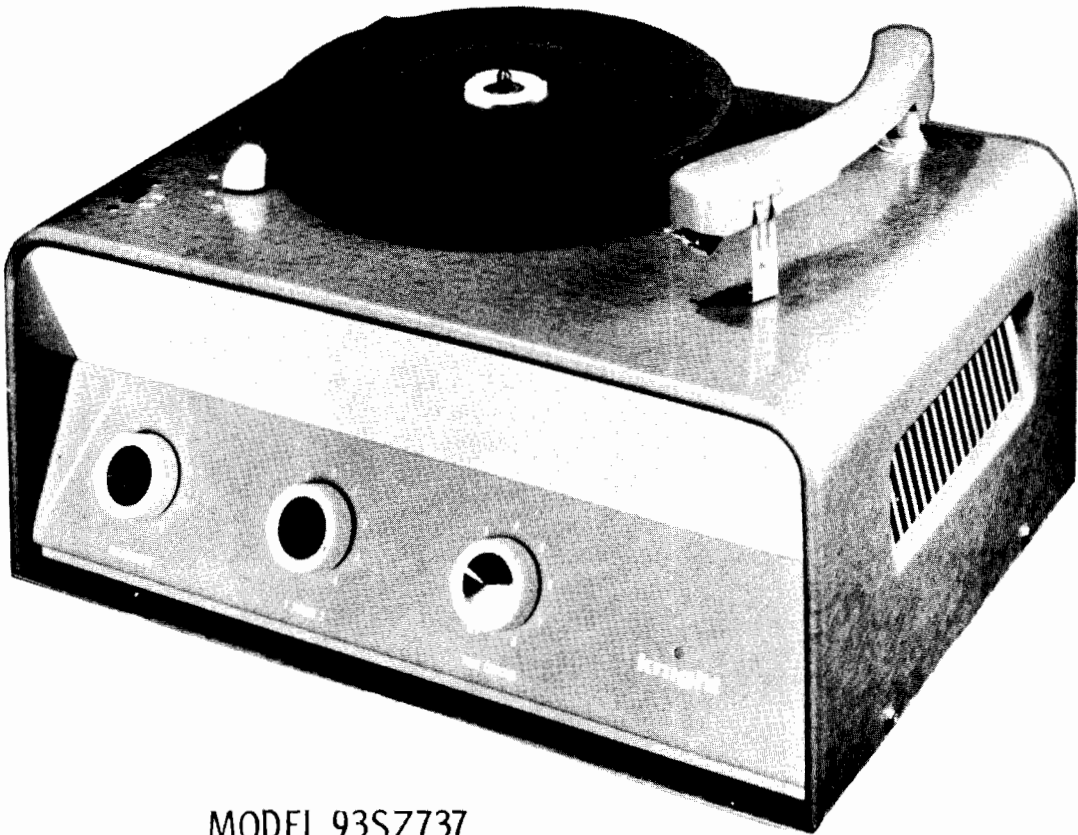
This control should be adjusted if an output tube (V5, V6, V7, or V8) is replaced. Connect a suitable load (speaker or resistor) across the speaker terminals and allow the amplifier to warm-up. Connect an oscilloscope across the speaker terminals. With volume control at minimum, adjust R6 for a straight line on the screen of the scope. If an oscilloscope is not available, an AC VTVM may be connected across the speaker terminals and R6 adjusted for a minimum reading on the meter. (This should be approximately 1-5 millivolt).

SIGNAL BALANCE ADJUSTMENT (R4)

This control should be adjusted if new tubes are installed in the amplifier. The "Bias Balance" control (R6) should be adjusted prior to adjusting R4. Connect an IM analyzer, with a signal ratio of 4:1, to the amplifier. Set volume control for maximum output. Adjust the "Signal Balance" control (R4) for minimum IM.

CABINETS & CABINET PARTS

(When Ordering Cabinets & Cabinet Parts, Specify Model, Chassis & Color)



MODEL 93SZ737

KNIGHT
MODELS 93SZ505, 93SZ737

TRADE NAME	Knight Models 93SZ505, 93SZ737		
SUPPLIER	Allied Radio Corp., 100 N. Western Ave., Chicago 80, Illinois		
TYPE SET	AC Operated 16 Watt 3 Channel Audio Amplifier (Model 93SZ737 Has 4 Speed Manual Record Player)		
TUBES (Five)	Types 6AV6 Mic. Preamplifier, ECC83 (or) 12AD7 (or) 12AX7 AF Amplifier, (2) 6V6GT Output, 5Y3GT Rectifier		
POWER SUPPLY	110-120 Volts AC - 60 Cycles	RATING	.6 Amp. @ 117 Volts AC, 62 Watts

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PARTS LIST AND DESCRIPTIONS
TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Mic. Pre-amplifier	6AV6	
V2	Mic. Amplifier	6V6GT	
V3	Output	6V6GT	
V4	Output	6V6GT	
V5	Rectifier	5Y3GT	

Note 1. Some versions use a 12AD7 in this application.

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA				
	CAP.	VOLT.	KNIGHT PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.
C1A	40	450		AFB3-41	C0320	FP386.2	Q-055
C1B	10	450					
C1C	10	450					
C2	8	450		PRS450V8	BR845	TC71	TD-8-450
C3	35	50		PRS150V40	BR505	TC48	TD-40-150

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA						NOTES
	CAP.	VOLT.	KNIGHT PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	
C4	10000			BPD-01	DD-103	BYA6S1	ED-01	DCS11	5HK-81
C5	10000			BPD-01	DD-103	BYA6S1	ED-01	DCS11	5HK-81
C6	500				DD-501		ED-500		
C7	150				DD-151	LI0715	ED-150		
C8	2200	600		P688N-047	DF-503	CUB6S47		GEM-6147	8TM-547
C9	.047	600		P688N-047	DF-503	CUB6S47		GEM-6147	8TM-547
C10	.047	600		P688N-047	DF-503	CUB6S47		GEM-6147	8TM-547
C11	.047	600		P688N-047	DF-503	CUB6S57		GEM-612	8TM-52
C12	.047	600							
C13	.02	600		P688N-02	DD-203	CUB6S2			

CONTROLS

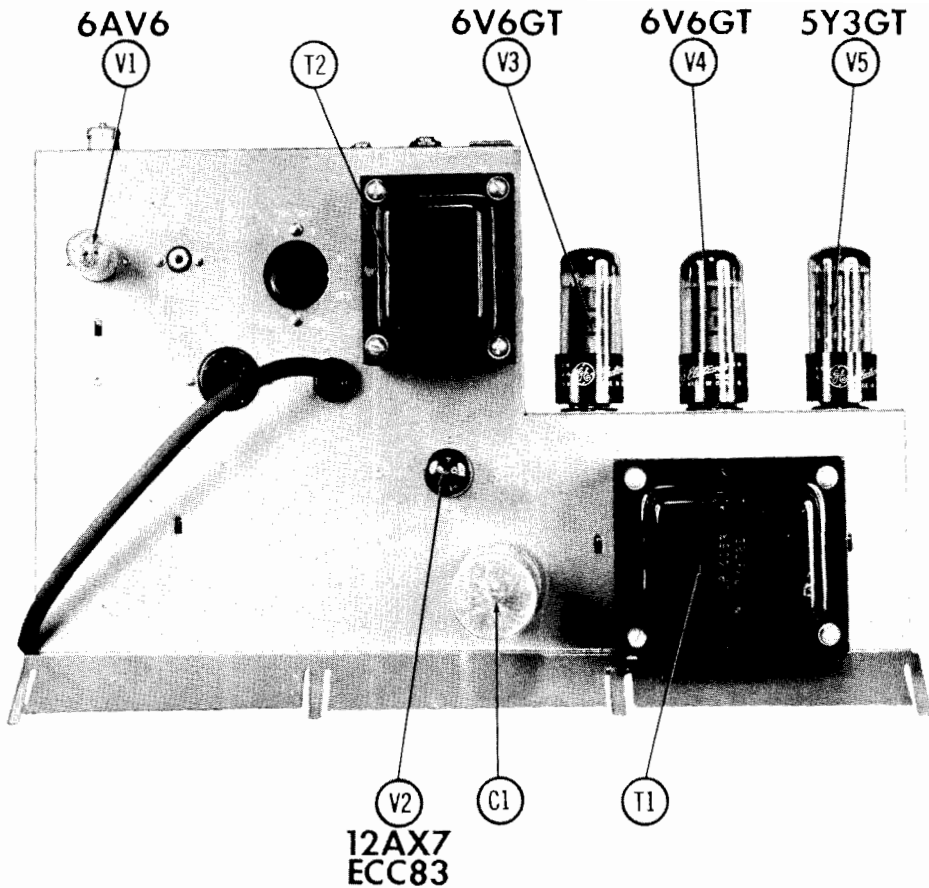
ITEM No.	RATING		REPLACEMENT DATA				INSTALLATION NOTES
	RESIST. ANCE	WATTS	KNIGHT PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	
R1A	1Meg	1/2		B-70	A47-1Meg-Z	Q13-137	Tone
R1B	Shaft			Not Req.	KSS-3	Not Req.	
R2	4Meg	1/2		KB-1	SWE-12	76-1	
R3A	1Meg	1/2		B-70	A47-1Meg-Z	Q13-137	Phono #1 & #2, Tap @ 2Meg
R3B	Shaft			Not Req.	KSS-3	Not Req.	Mic. Input

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	KNIGHT PART No.	IRC PART No.	
R4	10Meg				
R5	470K				
R6	220K				
R7	470K				
R8	470K				
R9	2700Ω				
R10	330K				
R11	470K				
R12	470K				
R13	100K				BTS-100K
R14	1000Ω				BTS-1000
R15	100K				BTS-100K
R16	470K				BTS-470K
R17	250Ω	4			PW4-250
R18	470K				BTS-470K
R19	3300Ω	1			BTA-3300
R20	10K				BTS-10K
R21	22K				BTS-22K

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (POWER)

ITEM No.	RATING			REPLACEMENT DATA			
	PRI.	SEC. 1	SEC. 2	KNIGHT PART No.	Hollidorn PART No.	Merit PART No.	Thordorson PART No.
T1	117VAC ⑤ .6A	640VCT ⑤ .076A	5VAC ⑤ 2A ⑤ 1.5A	LP-0258	P9315	P-2953	PM8410
							22R05
							R-148

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA				NOTES
	PRI.	SEC.	KNIGHT PART No.	Hollidorn PART No.	Merit PART No.	Thordorson PART No.	
T2	6000Ω CT	500Ω Tap 75Ω, 250Ω, 16Ω, 8Ω, 4Ω	L0-0150				

PHONO CARTRIDGE

ITEM No.	REPLACEMENT DATA			REMARKS
	KNIGHT PART No.	ASTATIC CARTRIDGE	ELECTRO-VOICE CARTRIDGE	
M1		55T * P-55-T	GD 56 PT-2 * 2756	* Tone Arm Complete With Cartridge.

ASTATIC NEEDLE LISTING SHOWN ABOVE IS SPECIFIED FOR THE RESPECTIVE REPLACEMENT CARTRIDGE LISTED. FOR ORIGINAL CARTRIDGE NEEDLE REPLACEMENTS SEE BELOW.

PHONO NEEDLE

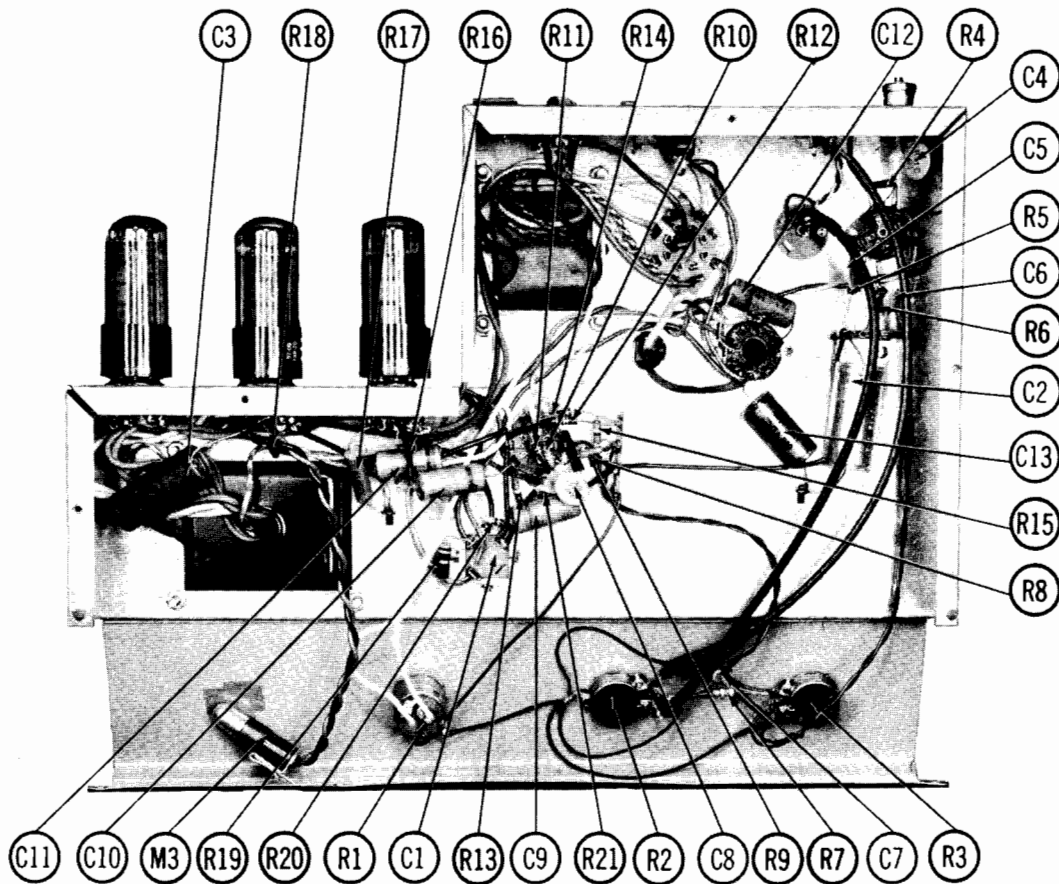
(FOR REPLACEMENT IN ORIGINAL EQUIPMENT CARTRIDGE)

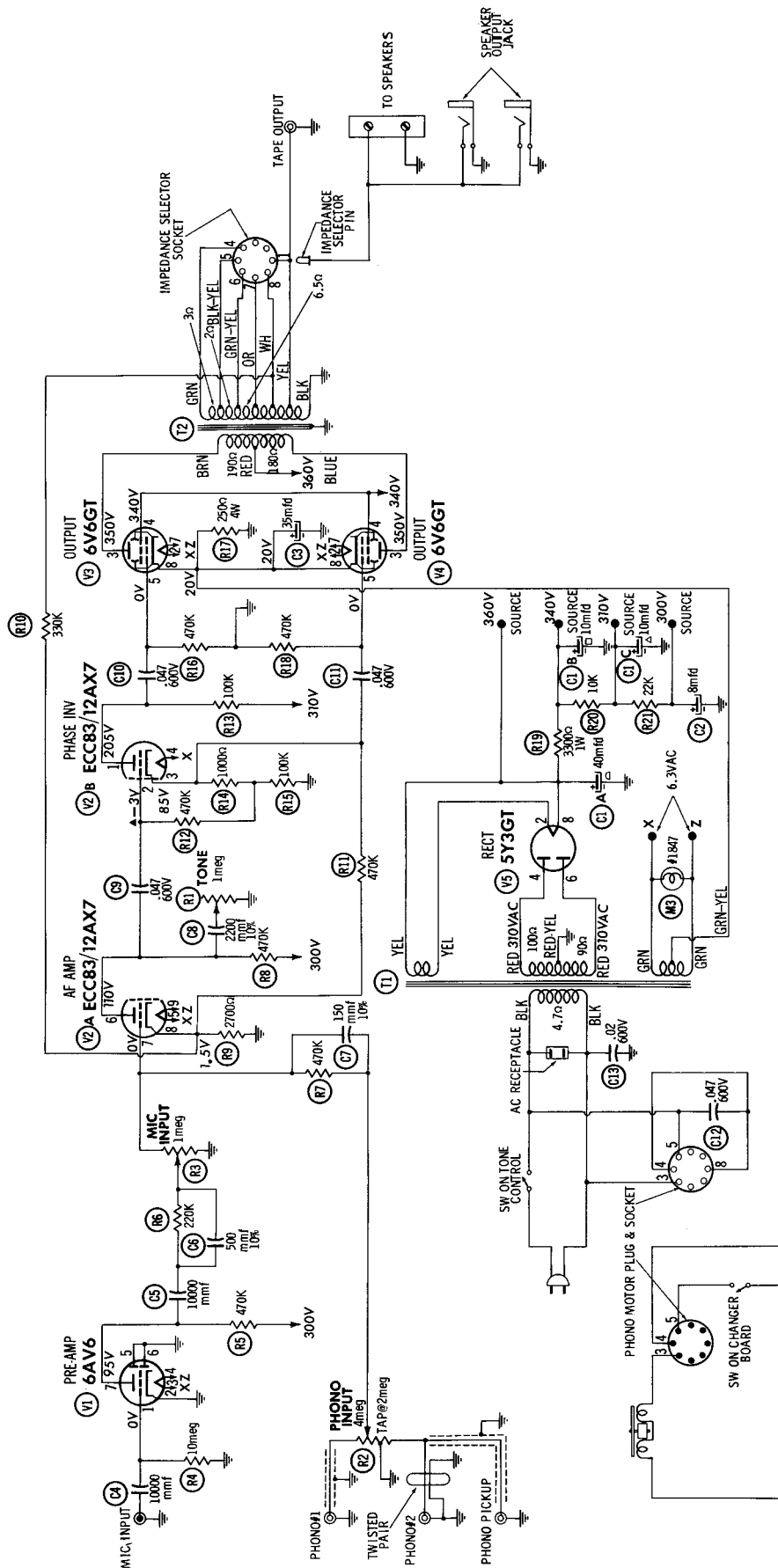
ITEM No.	REPLACEMENT DATA			REMARKS
	KNIGHT PART No.	JENSEN PART No.	WALCO PART No.	
M2		† A-7L or † A-7LSD or * A-7LD	* W-8T PA or † W-8T PS or † W-8DS or * W-8T PD	* Metal † Jewel * Diamond

MISCELLANEOUS

ITEM No.	PART NAME	KNIGHT PART No.	NOTES
M3	Panel Lamp		#1847

CHASSIS—BOTTOM VIEW





RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	6AV6	10Meg	0Ω	250Ω	250Ω	0Ω	0Ω	† 500K		
V2	ECC83/12AX7	† 110K	570K	100K	250Ω	250Ω	† 500K	650K	2500Ω	250Ω
V3	6V6GT	0Ω	250Ω	† 190Ω	† 3300Ω	470K	NC	250Ω	250Ω	
V4	6V6GT	0Ω	250Ω	† 180Ω	† 3300Ω	470K	NC	250Ω	250Ω	
V5	5Y3GT	NC	20K(1M)	TP	100Ω	TP	90Ω	NC	20K(1M)	

† MEASURED FROM PIN 2 OF V5

‡ MEASURED FROM PIN 3 OF V2

TP TIE POINT

NC NO CONNECTION

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of $\pm 15\%$ in voltage and resistance readings.
6. All controls at minimum, proper output load connected.



KNIGHT
MODEL 93SZ645

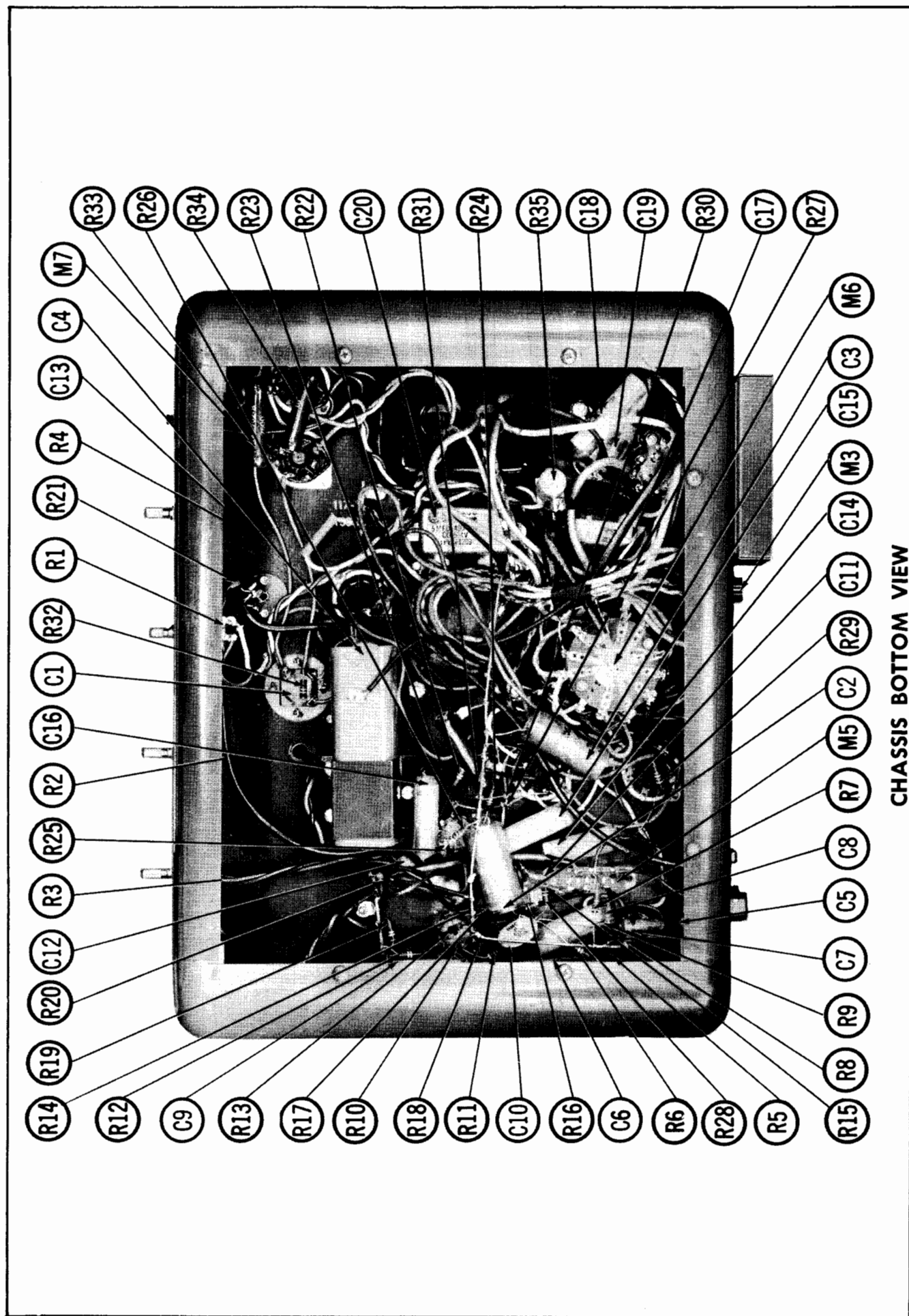
TRADE NAME	Knight Model 93SZ645		
SUPPLIER	Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.		
TYPE SET	AC (or) Battery Operated 4 Channel 25 Watt Mobile Audio Amplifier		
TUBES (Seven)	Types 12AX7 Mic. 1-Mic. 2-Mag. Preamp., 12AX7 Mic. 1-Mic. 2-Mag. Preamp. 12AX7 AF Amp. -Phase Inv., (2) 6L6G Output, (2) 6X5GT Rectifier		
POWER SUPPLY	110-130 Volts AC - 60 Cycles (or) 6 Volt Storage Battery (or) 12 Volt Storage Battery	RATING	.92 Amp. @ 117 Volts AC (100 Watts) (or) 15.5 Amp. @ 6.3 Volts DC (or) 8.75 Amp. @ 12.6 Volts DC

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G791



PARTS LIST AND DESCRIPTIONS

ITEM No.	USE	TYPE	NOTES
V1	Mic. 1-Mic. 2-Mag. Preamp.	12AX7	
V2	Mic. 1-Mic. 2-Mag. Preamp.	12AX7	
V3	AF Amp. -Phase Inverter	12AX7	
V4	Output	6L6G	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA					SANGAMO PART No.	SPRAGUE PART No.
	CAP.	VOLT.	KNIGHT PART No.	AEROVOX PART No.	CONVALL CUMMINS PART No.	MALLORY PART No.	PYRAMID PART No.		
C1A	40	450		AFH3-41	CO320	FP306-2	TMT-36	Q-055	TVL-3763
C1B	10	450							
C2	40	450							
C3	6	450		PRS450V8	BR445	TC71	TD-B-450	FM-4508	TVA-1704
C3	5	450		PR150V40	BR505	TC39	TD-50-50	FM-0550	TVA-1308
C3	35	50		JPG306R600V4	TTJ6040	TX803	PLM6-4	7106-4	CR46
C4	4.0	600							

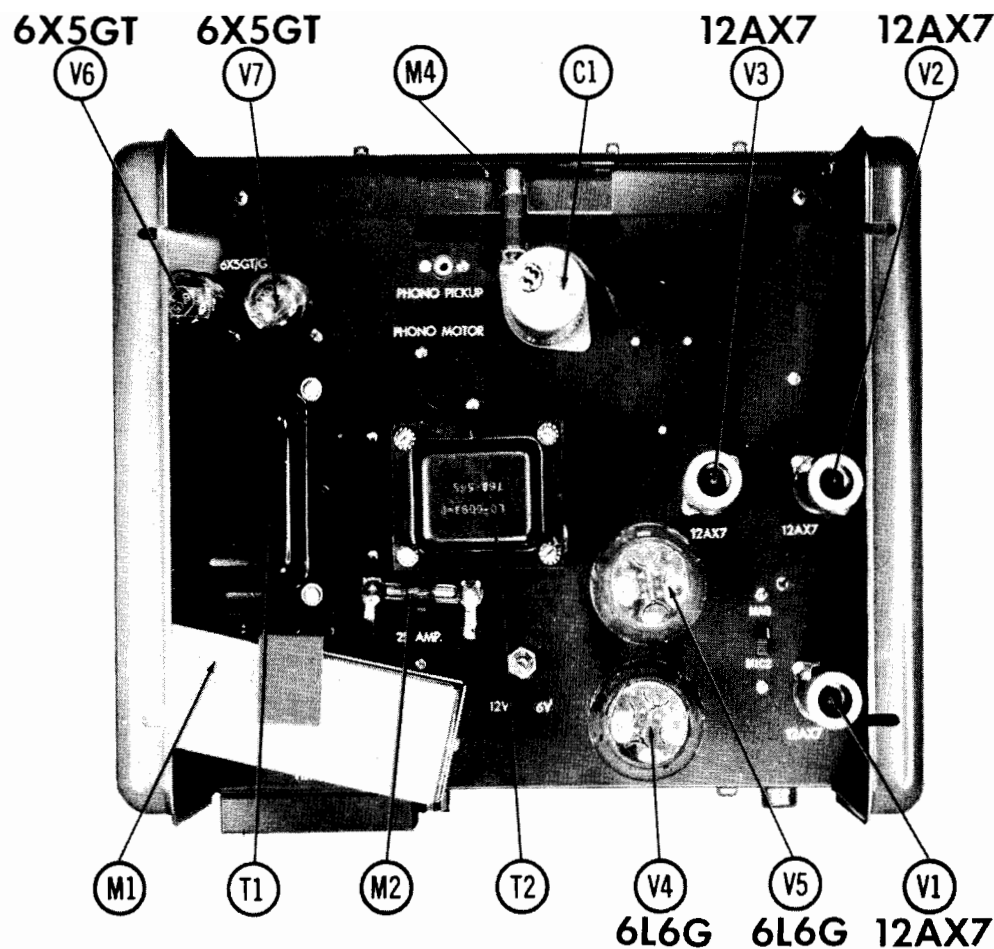
FIXED CAPACITORS

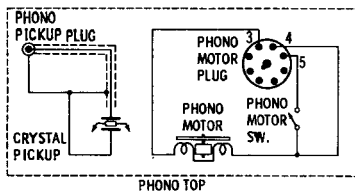
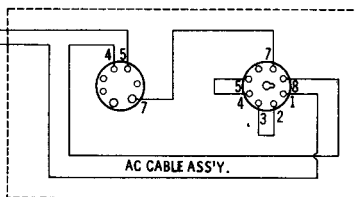
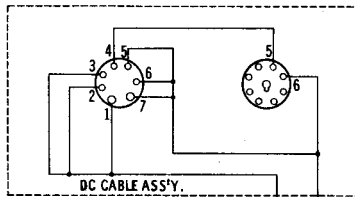
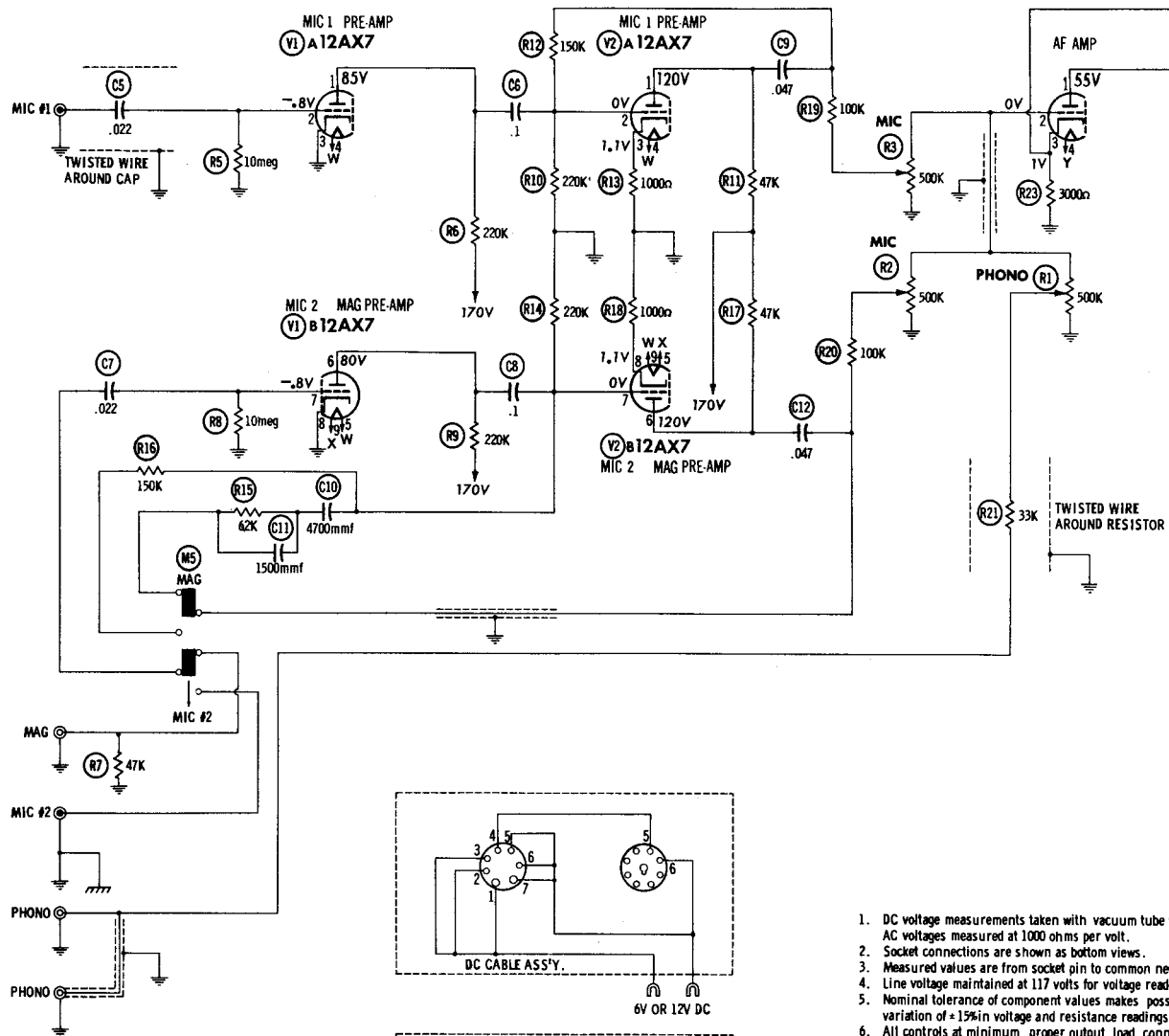
Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		KNIGHT PART No.	AEROVOX PART No.	CENTRALAB PART No.	REPLACEMENT DATA				NOTES
	CAP.	VOLT				CORNELL-DUBILIER PART No.	ERIE PART No.	MALLOY PART No.	SPRAGUE PART No.	
C5	.022	200		BPD-02	DD-203	CU34522	ED-02	GEM-4122	4TM-522	
C6	.022	400		P68N-1	DF-404	CU360P1		GEM-401	6TM-21	
C7	.022	200		BPD-02	DD-203	CU34522	ED-02	GEM-4122	4TM-522	
C8	.047	800		P68N-1	DF-404	CU360P1		GEM-401	6TM-21	
C9	.047	800		BPD-05	DF-303	CU360S1		GEM-0147	6TM-547	
C10	.047	800		BPD-05	DF-303	CU360S1		UC-5247	5GA-515	
C11	.047	1500		BPD-0015	DD-152	KOTL	ED-0015	UC-5215	5GA-515	
C12	.047	800		BPD-05	DF-303	CU360S1		GEM-0147	6TM-547	
C13	.047	800		BPD-05	DF-303	CU360S1		GEM-0147	6TM-547	
C14	.047	800		BPD-05	DF-303	CU360S1		GEM-0147	6TM-547	
C15	.047	800		BPD-05	DF-303	CU360S1		GEM-0147	6TM-547	
C16	.047	800		BPD-05	DF-303	CU360S1		GEM-0147	6TM-547	
C17	.047	200		P68N-47	DF-404	CU362P47		GEM-4047	2TM-547	
C18	.047	200		P68N-47	DF-404	CU362P47		GEM-4047	2TM-547	
C19	.047	200		P68N-47	DF-404	CU362P47		GEM-4047	2TM-547	
C20	.047	200		P68N-47	DF-404	CU362P47		GEM-4047	2TM-547	

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESIST-ANCE	WATTS	KNIGHT PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IBC PART No.	MALLOY PART No.	
RIA	500K	$\frac{1}{2}$		AB-59	A47-500K-S	Q1-133	U50	Phono Volume
B	Shaft		AK-4	AK-4	KSS-3	Not Req.	Not Req.	
C	Switch		KB-1	KB-1	SVB-12	78-1	US-26	
R2A	500K	$\frac{1}{2}$	AK-4	AB-60	A47-500K-Z	Q3-133	U46	Mic. 2-Mag. Volume
B	Shaft		AK-4	AK-4	KSS-3	Not Req.	Not Req.	
R3A	500K	$\frac{1}{2}$	AK-4	AB-60	A47-500K-Z	Q3-133	U46	Mic. 1 Volume
B	Shaft		AK-4	AK-4	KSS-3	Not Req.	Not Req.	
R4A	500K	$\frac{1}{2}$	AK-4	AB-60	A47-500K-Z	Q3-133	U46	Tone
B	Shaft		AK-4	AK-4	KSS-3	Not Req.	Not Req.	





1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of $\pm 15\%$ in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7	$\dagger 245K$	10Meg	0 ∞	200 ∞	200 ∞	$\dagger 245K$	10Meg	0 ∞	200 ∞
V2	12AX7	$\dagger 75K$	100K	1000 ∞	200 ∞	200 ∞	$\dagger 75K$	220K	1000 ∞	200 ∞
V3	12AX7	$\dagger 485K$	125K	3000 ∞	200 ∞	200 ∞	$\dagger 65K$	550K	48K	200 ∞
V4	6L6G	TP	200 ∞	$\dagger 100\infty$	$\dagger 7500\infty$	470K	TP	200 ∞	200 ∞	
V5	6L6G	TP	200 ∞	$\dagger 100\infty$	$\dagger 7500\infty$	470K	TP	200 ∞	200 ∞	
V6	6X5GT	NC	200 ∞	110 ∞	NC	110 ∞	TP	200 ∞	30K	
V7	6X5GT	NC	200 ∞	120 ∞	TP	120 ∞	NC	200 ∞	30K	

$\dagger$ MEASURED FROM PIN 8 OF V6
NC NO CONNECTION
TP TIE POINT

A PHOTOFAC STANDARD NOTATION SCHEMATIC
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PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	KNIGHT PART No.	IRC PART No.		OHMS	WATT	KNIGHT PART No.	IRC PART No.	
R5	10Meg			BTS-10Meg	R21	33K			BTS-33K	
R6	220K			BTS-220K	R22	470K			BTS-470K	
R7	47K			BTS-47K	R23	30000 5%			BTS-3000 5%	
R8	10Meg			BTS-10Meg	R24	47K			BTS-47K	
R9	220K			BTS-220K	R25	6800			BTS-680	
R10	220K			BTS-220K	R26	47K			BTS-47K	
R11	47K			BTS-47K	R27	100K			BTS-100K	
R12	150K			BTS-150K	R28	10K			BTS-10K	
R13	10000			BTS-10000	R29	470K			BTS-470K	
R14	220K			BTS-220K	R30	2000	10		BTS-2000	
R15	62K 5%			BTS-62K 5%	R31	10K			BTS-10K	
R16	150K			BTS-150K	R32	10K			BTS-10K	
R17	47K			BTS-47K	R33	75000	10		PW10-7500	
R18	10000			BTS-10000	R34	10K	10		PW10-10	
R19	100K			BTS-100K	R35	.20	20			
R20	100K			BTS-100K						

PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA				NOTES
	PRI.	SEC.	KNIGHT PART No.	Halldorson PART No.	Stancor PART No.	Triad PART No.	
T2	8KCT	500Ω Tap @ 2500, 187Ω (70V), 16Ω, 8Ω, 4Ω	L.O.-0083-D				

VIBRATOR

ITEM No.	TYPE	INPUT VOLTS/SEQUENCY	FRE.	REPLACEMENT DATA				NOTES
				KNIGHT PART No.	CORNEIL-DOUBLER PART No.	MALLORY PART No.	RADIART PART No.	
M1	Interrupter	8 or 12	80%	JV-0021	6VB60L		8VB60L	

TRANSFORMER (POWER)

ITEM No.	RATING			REPLACEMENT DATA				Triad PART No.
	PRI.	SEC. 1	SEC. 2	SEC. 3	KNIGHT PART No.	Halldorson PART No.	Stancor PART No.	
T1	AC OPERATION				LP-0239A			
	180VAC	600VCT ①	63VCT ①					
	Tap③	② 15A	③ 15A					
	117VAC	63VCT ①	63VCT ①					
	② . 82A	③ 22A	④ 22A					
	DC OPERATION							
	PRI. 1	600VCT						
	63VCT ③	② . 120A						
	② 2.5A							
	63VCT ④							
	② 3A							
	PRI. 2	63VCT ③						
	② 2.5A							
	63VCT ④							
② 3A								

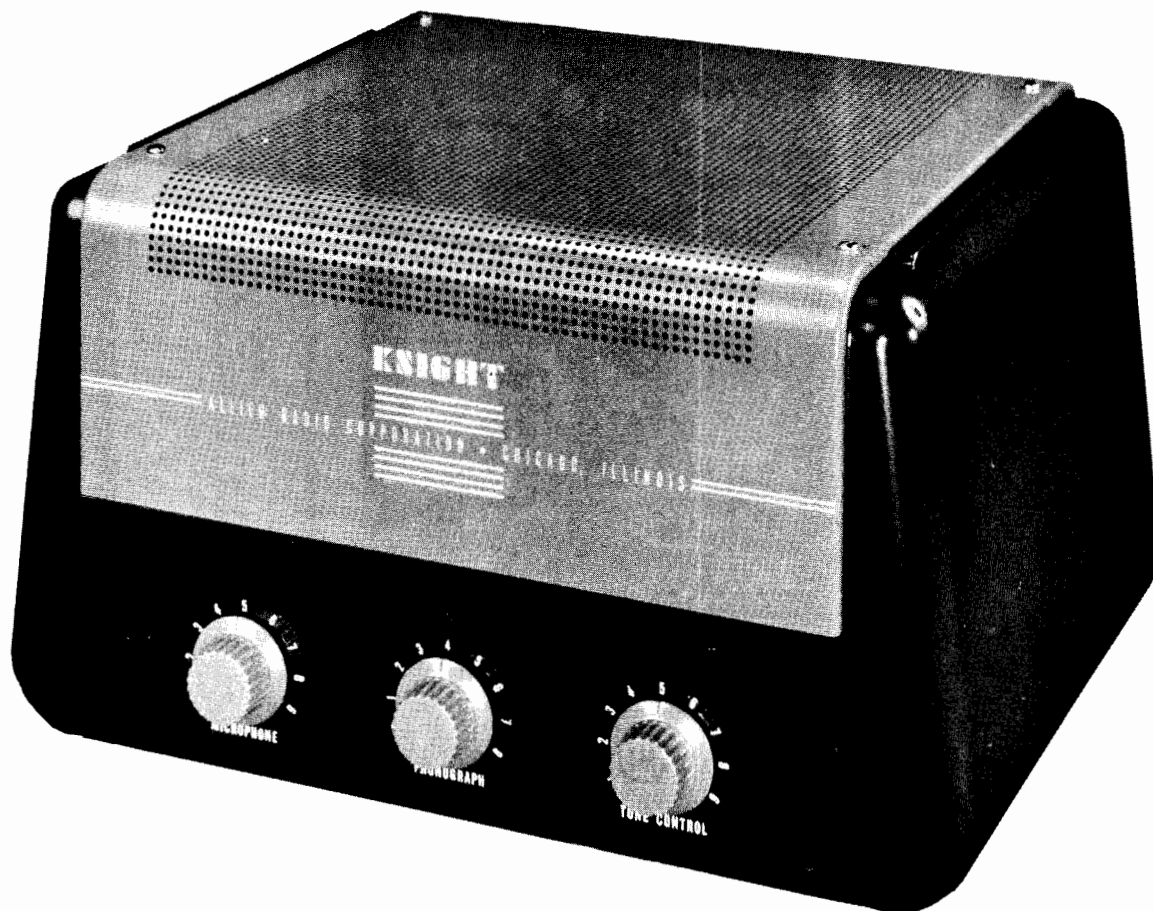
- ① 6V filament operation.
② 12V filament operation.
③ 6V input operation.
④ 12V input operation.

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA			
			KNIGHT PART No.	Halldorson PART No.	Stancor PART No.	Triad PART No.
M2	4U	25A				
	4AG	32V				
M3	3AG	6 1/4A				
		32V				

MISCELLANEOUS

ITEM No.	PART NAME	KNIGHT PART No.	NOTES
M4	Pilot Light		
M5	Switch		
M6	Switch		
M7	Switch		



**KNIGHT
MODEL 93SZ655**

TRADE NAME	Knight Model 93SZ655	
SUPPLIER	Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.	
TYPE SET	AC Operated 3 Channel 15 Watt Audio Amplifier	
TUBES (Five)	Types 6SJ7 Mic Preamplifier, 6SC7 AF Amp. -Phase Inv., (2) 6V6GT Output, 5Y3GT Rectifier	
POWER SUPPLY	105-130 Volts AC 50/60 Cycles	RATING .8 Amp. @ 117 Volts AC (75 Watts)

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PARTS LIST AND DESCRIPTIONS TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Mic Pre-amplifier	6SJ7	
V2	AF Amp. -Phase Inv.	6SC7	
V3	Output	6V6GT	
ITEM No.	USE	TYPE	NOTES
V4	Output	6V6GT	
V5	Rectifier	5Y3GT	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA					
	CAP.	VOLT.	KNIGHT PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SPRAGUE PART No.
C1A	.40	450		AFH3-41	CO320	FP398. 2	TMT-36	Q-055
C1B	.10	450					TD-8-450	FM-4508
C2	8	450		PRS450V8	BR845	TC71	TD-50-50	FM-0550
C3	.35	50		PRS150V40	BR505	TC39		

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA						NOTES
	CAP.	VOLT.	KNIGHT PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	
C4	.047	600		BPD-05	DF-503	CUB6847	CUB6847	GEM-6147	6TM-847
C5	.047	600		BPD-05	DF-503	CUB6847	CUB6847	GEM-6147	6TM-847
C6	.047	600		BPD-05	DF-503	CUB6847	CUB6847	GEM-6147	6TM-847
C7	.220	600		BPD-05	DF-503	CUB6847	CUB6847	GEM-6147	6TM-847
C8	.0022	600		BPD-05	DF-503	CUB6847	CUB6847	GEM-6147	6TM-847
C9	.047	600		BPD-05	DF-503	CUB6847	CUB6847	GEM-6147	6TM-847
C10	.047	600		BPD-05	DF-503	CUB6847	CUB6847	GEM-6147	6TM-847
C11	.05	600		BPD-05	DF-503	CUB6847	CUB6847	GEM-6147	6TM-847
C12	.047	600		BPD-05	DF-503	CUB6847	CUB6847	GEM-6147	6TM-847

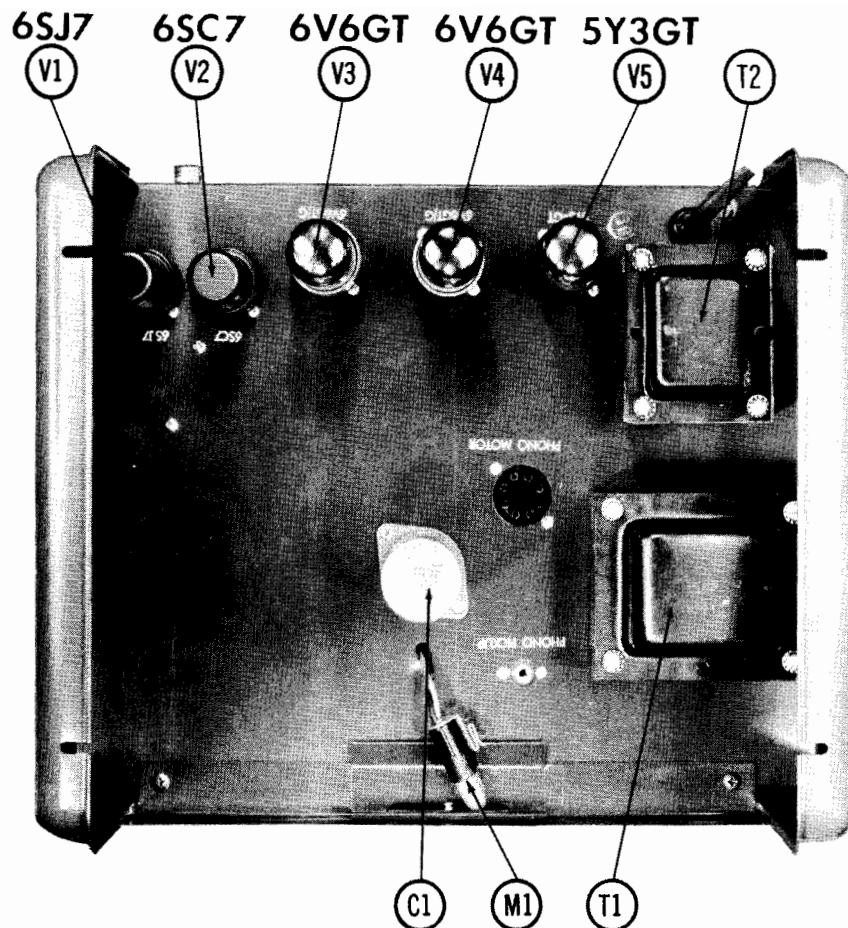
CONTROLS

ITEM No.	RATING		REPLACEMENT DATA						INSTALLATION NOTES
	RESIST-ANCE	WATTS	KNIGHT PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.		
R1A	500K	1/2		AB-59	A47-500K-S	Q1-133	U50	Phono	
R1B	Shaft			AK-4	KSR-3	Not Req.	Not Req.		
R1C	Switch			KB-1	SWE-12	76-1	US-26		
R2A	500K	1/2		AB-60	A47-500K-Z	Q3-133	U48	Mic.	
R2B	Shaft			AK-4	KSR-3	Not Req.	Not Req.		
R3A	500K	1/2		AB-60	A47-500K-Z	Q3-133	U48	Tone	
R3B	Shaft			AK-4	KSR-3	Not Req.	Not Req.		

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	KNIGHT PART No.	IRC PART No.	
R4	100K				
R5	10Meg				
R6	470K				
R7	470K				
R8	2.2Meg				
R9	470K				
R10	470K				
R11	10K				
R12	470K				BTS-470K
R13	15000				BTS-1500
R14	10K				BTS-10K
R15	10K				BTS-10K
R16	470K				BTS-470K
R17	2500				PW10-250
R18	33000				BTA-3300



PARTS LIST AND DESCRIPTIONS (Continued) **TRANSFORMER (POWER)**

ITEM No.	RATING				REPLACEMENT DATA			
	PRI.	SEC. 1	SEC. 2	SEC. 3	KNIGHT PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.
T1	130VAC tap @ 117VAC @ .5A	850VCT @ .085A @ 3A	5VAC @ 3A	6.3VCT @ 1.85A	LP-0168			22R08 ①

① This transformer does not provide a tap on primary winding for 130VAC input.

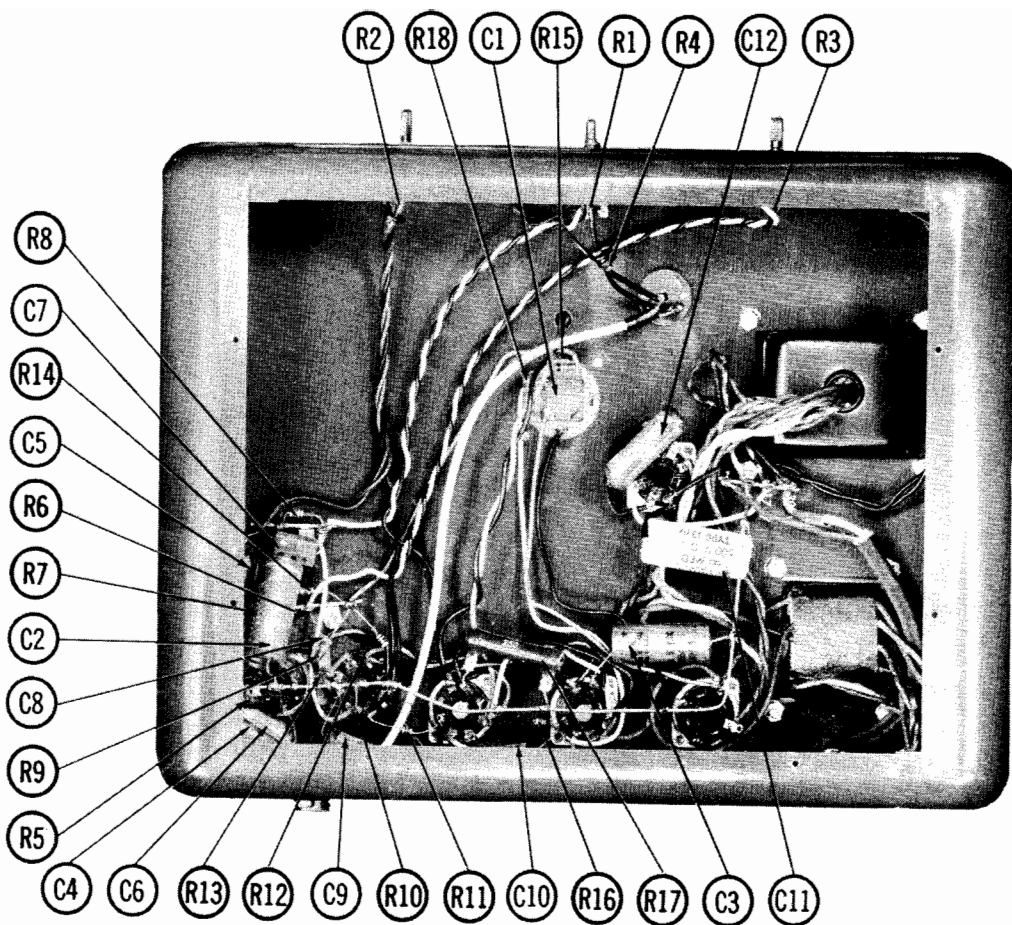
TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA				NOTES
	PRI.	SEC.	KNIGHT PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	
T2	10K CT	500Ω tap @ 333Ω (70V), 250Ω, 160, 8Ω, 4Ω	LO-0092-B				

MISCELLANEOUS

ITEM No.	PART NAME	KNIGHT PART No.	NOTES
M1	Pilot Light		#44

CHASSIS—BOTTOM VIEW



† MEASURED FROM PIN 8 OF V5.
NC NO CONNECTION

1. DC voltage measurements taken with vacuum tube voltmeter;
2. AC voltages measured at 1000 ohms per volt.
3. Socket connections are shown as bottom views.
4. Measured values are from socket pin to common negative.
5. Line voltage maintained at 117 volts for voltage readings.
6. Nominal tolerance of component values makes possible a variation of $\pm 15\%$ in voltage and resistance readings.
7. All controls at minimum, proper output load connected.



**KNIGHT
MODEL 93SZ682**

TRADE NAME	Knight Model 93SZ682	
SUPPLIER	Allied Radio Corp., 100 N. Western Ave., Chicago 80, Illinois	
TYPE SET	AC Operated 5 Channel 30 Watt Audio Amplifier	
TUBES (Six)	Types 6SC7 Preamplifier, 6SC7 Mixer, 6SC7 AF Amp. - Phase Inv., (2) 6L6G Output, 5U4G Rectifier	
POWER SUPPLY	105-130 Volts AC-50/60 Cycles	RATING 1.18 Amp. @ 117 Volts AC (125 Watts)

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PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	MIC 1 Preamplifier -	6SC7	
V2	MIC 2 - Mag Preamplifier	6SC7	
V3	AF Amp. - Phase Inv.	6SC7	
V4	Output	6L6G	
V5	Output	6L6G	
V6	Rectifier	5U4G	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA				
	CAP.	VOLT.	KNIGHT PART No.	AEROVOX PART No.	CORNEILL-DUBIER PART No.	MALLORY PART No.	SPRAGUE PART No.
C1A	.40	450		AFH3-41	C0320	FP388-2	Q-085
C1B	.10	450		PR845	TC71	TD-8-450	FM-4508
C2	.10	450		PR8150V40	TC39	TD-50-50	FM-0850
C3	.35	50					

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT.	KNIGHT PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNEILL-DUBIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.
C4	.047	600		BPD-05	DF-503	CUB6847	CUB6847	GEM-6147	6TM-847
C5	.047	600		BPD-05	DF-503	CUB6847	CUB6847	GEM-6147	6TM-847
C6	.047	600		BPD-05	DF-503	CUB6847	CUB6847	GEM-6147	6TM-847
C7	.01	4700		BPD-0047	DD-472	K079	ED-0047	UC-5247	5HK-D47
C8	.01	600		BPD-01	DD-103	CUB681	ED-01	GEM-611	6TM-S1
C9	.047	600		BPD-05	DD-503	CUB6847	CUB6847	GEM-6147	6TM-847
C10	.047	600		BPD-05	DD-503	CUB6847	CUB6847	GEM-6147	6TM-847
C11	.39	600		1489-000039	D8-332	5R5Q39	ED-0033	GEM-6233	MS-439
C12	.0033	600		BPD-0033	1489-000022	5R5T22		GEM-6147	MS-322
C13	.220	600		BPD-05	DF-503	CUB6847	CUB6847	GEM-6147	6TM-847
C14	.047	600		BPD-05	DF-503	CUB6847	CUB6847	GEM-615	6TM-S5
C15	.047	600		BPD-05	DF-503	CUB6847	CUB6847	GEM-6147	6TM-847
C16	.05	600		BPD-05	DF-503	CUB6847	CUB6847	GEM-6147	6TM-847
C17	.047	600		BPD-05	DF-503	CUB6847	CUB6847	GEM-6147	6TM-847

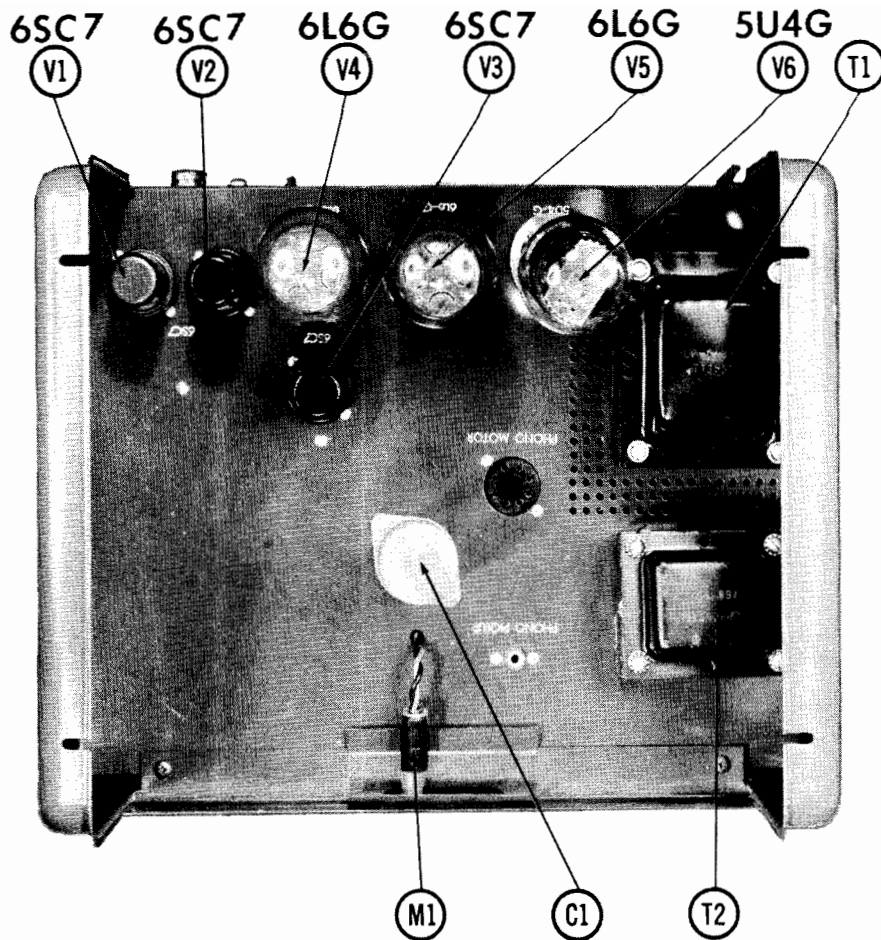
Note #1. Some Versions Use 330MMF in This Application.

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA				
	RESISTANCE	WATTS	KNIGHT PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.
R1A	500K	1/2		AB-59	A47-500K-S	Q11-133	U50
R1B	500K	1/2		AK-4	KSS-3	Not Req.	Not Req.
R1C	500K	1/2		KB-1	SWVE-12	78-1	US-28
R2A	500K	1/2		AB-59	A47-500K-S	Q11-133	U50
R2B	500K	1/2		AK-4	KSS-3	Not Req.	Not Req.
R2C	500K	1/2		KB-1	SWVE-12	78-1	US-28
R3A	500K	1/2		AB-59	A47-500K-Z	Q33-133	U48
R3B	500K	1/2		AK-4	KSS-3	Not Req.	Not Req.
R4A	500K	1/2		KB-1	SWVE-12	78-1	U48
R4B	500K	1/2		AB-59	A47-500K-Z	Q33-133	U48
R4C	500K	1/2		AK-4	KSS-3	Not Req.	Not Req.

INSTALLATION NOTES
Phono
MIC 2-Mag
MIC 1
Tone

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	KNIGHT PART No.	IRC PART No.	
R5	10Meg				
R6	220K				
R7	10Meg				
R8	100K				
R9	220K				
R10	47K				
R11	100K				
R12	22K				
R13	180K				
R14	1800Ω				
R15	1.5Meg				
R16	470K				
R17	10K				
R18	470K				
R19	470K				
R20	470K				
R21	1500Ω				
R22	10K				
R23	470K				
R24	200Ω	10			
R25	7500Ω	10			

TRANSFORMER (POWER)

ITEM No.	RATING		REPLACEMENT DATA	
	PRI.	SEC.	KNIGHT PART No.	Triad PART No.
T1	130V AC Tap @ 117V AC @ 1.18A	5V AC @ 3A @ 2.9A	LP-0108-B	24R05 ①

① This Transformer Does Not Provide A Tap On Primary Winding For 130V AC Input.

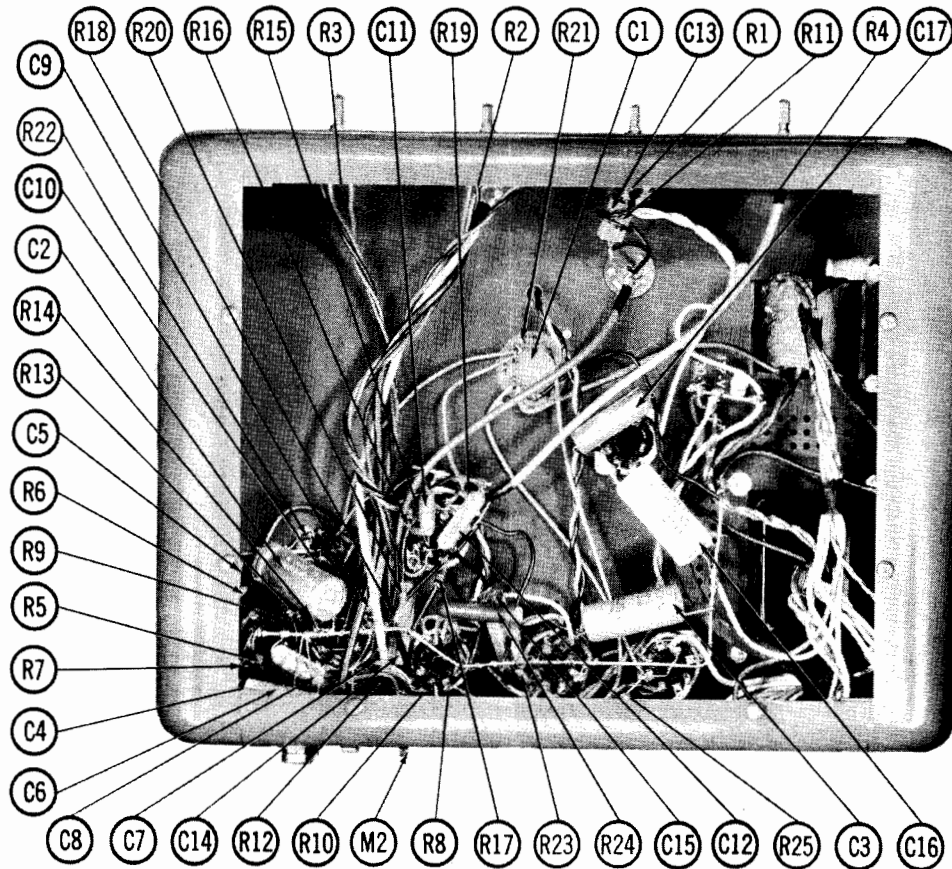
TRANSFORMER (AUDIO OUTPUT)

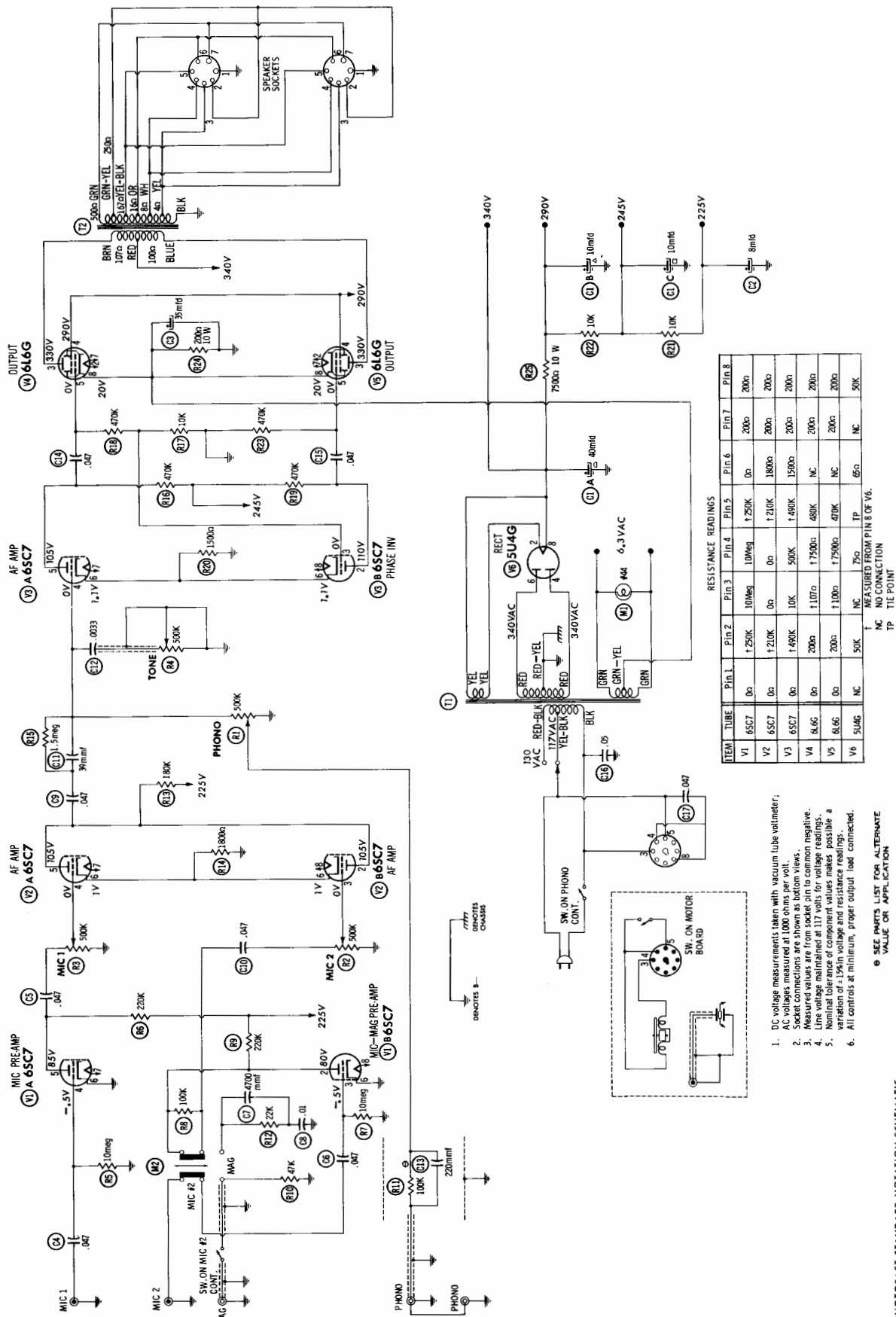
ITEM No.	IMPEDANCE		REPLACEMENT DATA		NOTES
	PRI.	SEC.	KNIGHT PART No.	Triad PART No.	
T2	8000Ω	500Ω Taps @ 250Ω, 160Ω, 160Ω, 80Ω, 40Ω	LO-0083-D		

MISCELLANEOUS

ITEM No.	PART NAME	KNIGHT PART No.	NOTES
M1	Pilot Light	444	
M2	Switch	Mag. - MIC 2, Slide Type (D. P. D. T.)	

CHASSIS—BOTTOM VIEW







**KNIGHT
MODEL 94SX706**

TRADE NAME	Knight Model 94SX706	
SUPPLIER	Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.	
TYPE SET	AC Operated Equalizer Preamplifier	
TUBES (Three)	Types 12AX7 Preamplifier, 12AX7 Cath. Follower - 1st AF Amp., 6C4 2nd AF Amplifier	
POWER SUPPLY	110-120 Volts AC-50/60 Cycles	RATING .15 Amp. @ 117 Volts AC (7 Watts)

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PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, PENNSYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Phono — Mic Preamplifier	12AX7	
V2	Cathode Follower-1st AF Amplifier	12AX7	

ITEM No.	USE	TYPE	NOTES
V3	2nd AF Amplifier	6C4	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA					
	CAP.	VOLT.	KNIGHT PART No.	AEROVOX PART No.	CORNELL DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANICAMO PART No.
C1A	30	150		AFH-08	C0070	FP225 [TC47]	TMD-7	T-025
C1B	15	150						
C1C	15	150						
C2A	10	150		AFH-22	C0210	FP330.5	TMT-22	T-096
C2B	10	150						
C2C	10	150						
C3	35	50		PR5150V40	BR505	TC39	TD-50-50	FM-0550

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

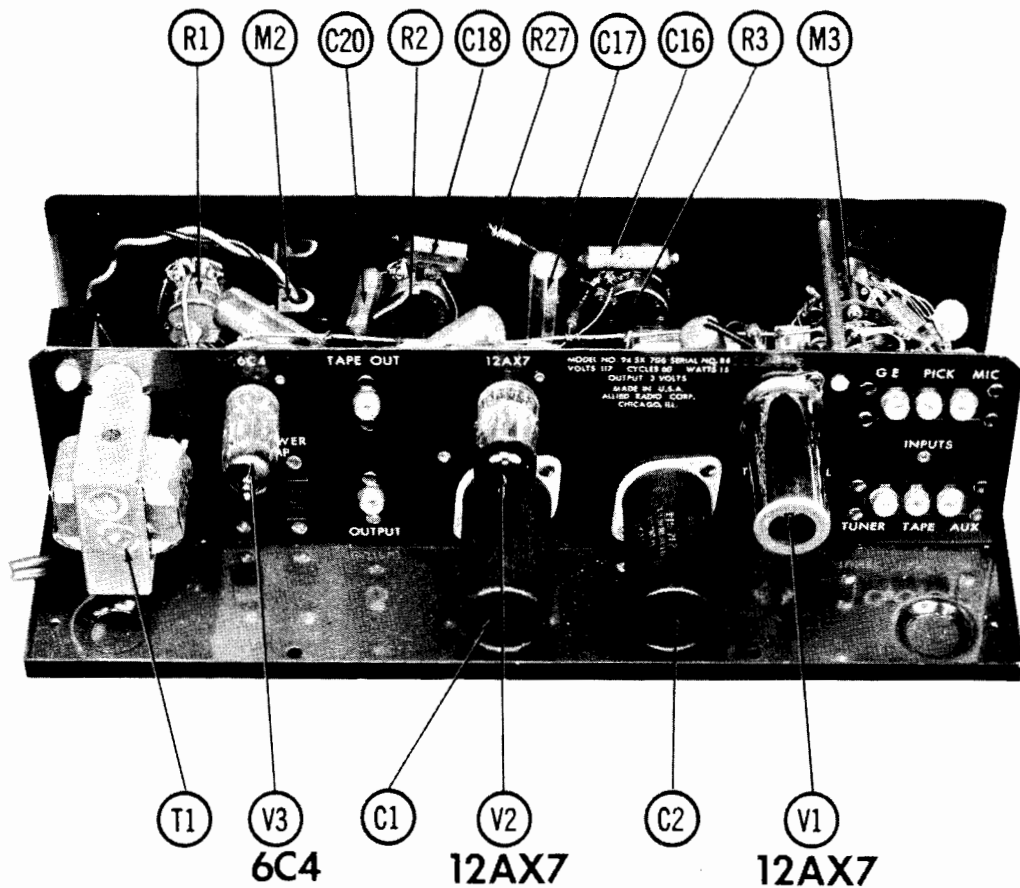
ITEM No.	RATING		REPLACEMENT DATA						NOTES
	CAP.	VOLT.	KNIGHT PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	
C4	.1	500		P668N-1	DF-104	CUB8F1	GEM-601	6TM-P1	Note 1
C5	.39	1000		BPD-0068	D8-683	CUB8D68	GP-6800	GEM-6268	
C6	.0068	500		BPD-0023	D8-223	K073	ED-0022	UC-5223	
C7	2200	500		BPD-001	DD-103	K088	ED-001	DC-521	
C8	1000	500		S1560	DD-561	C083	ED-560	UC-5356	
C9	500	500		BPD-0047	DD-472	K079	ED-0047	UC-5247	
C10	4700	500		BPD-00027	DD-271	C084	ED-270	UC-5327	
C11	.01	500		BPD-01	DD-103	CUB8S1	ED-01	GEM-412	
C12	.022	200		BPD-02	DD-203	CUB4S22	ED-02	GEM-4122	
C13	.022	200		BPD-02	DD-203	CUB4S22	ED-02	GEM-4122	
C14	.022	200		BPD-02	DD-203	CUB4S22	ED-02	GEM-4122	
C15	.0056	500		P668N-1	DF-104	CUB8F1		GEM-601	
C16	.0056	500							
C17	.0056	500							
C18	.15	500		1468-000015	DD-150	G056	ED-15	UC-5405	
C19	.39	500		BPD-00033	DD-331	CUB8D33	ED-330	UC-5333	
C20	.0033	500		BPD-00033	DD-332	CUB8D33	ED-0033	GEM-6233	
C21	.1	500		P668N-1	DF-104	CUB8F1		GEM-601	
C22	.1	500		P668N-1	DF-104	CUB8F1		GEM-601	
C23	.1	500		BPD-02	DD-203	CUB8S2	ED-02	GEM-612	

Note #1. Not used in some versions.

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	KNIGHT PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	500K	1/2		AB-59	A47-500K-S	Q1-133	U50	Volume
R1B	500K	1/2		AK-4	KSS-3	Not Req.	US-28	Treble
R1C	500K	1/2		KB-1	SW-12	76-1	U48	Bass
R2A	500K	1/2		AK-4	A47-500K-Z	Q1-133	Not Req.	Tuner Level
R2B	500K	1/2		AK-4	KSS-3	Q1-133	U48	
R2C	500K	1/2		AK-4	A47-500K-Z	Q1-133	Not Req.	
R3A	500K	1/2		AK-4	KSS-3	Q1-133	Not Req.	
R3B	500K	1/2		AK-4	A47-500K-Z	Q1-133	Not Req.	
R3C	500K	1/2		AK-4	KSS-3	Q1-133	Not Req.	

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	KNIGHT PART No.	IRC PART No.	
R5	27K			BTS-27K	
R6	22K			BTS-22K	
R7	470K			BTS-470K	
R8	68K			BTS-68K	
R9	68K			BTS-68K	
R10	68K			BTS-68K	
R11	68K			BTS-68K	
R12	100K			BTS-100K	
R13	150K			BTS-150K	
R14	100K			BTS-100K	
R15	220K 1/2			DCC-220K 1/2	
R16	47000 5%			BTS-4700 5%	
R17	47000			BTS-4700	
R18	470K			BTS-470K	
R19	47K 5%			BTS-47K 5%	
R20	15000 5%			BTS-1500 5%	

TRANSFORMER (POWER)

ITEM No.	RATING			REPLACEMENT DATA		
	PRI.	SEC. 1	SEC. 2	KNIGHT PART No.	Thornderson PART No.	Tried PART No.
T1	117VAC ④ .15A ⑤ .002A ⑥ .72A	120VAC 6.3VCT ④ .002A ⑤ .72A	SEC. 3	LP-0243	Stancor PART No. P-3046 ①	28R32 ①

① Drill New Mtg. Hole.

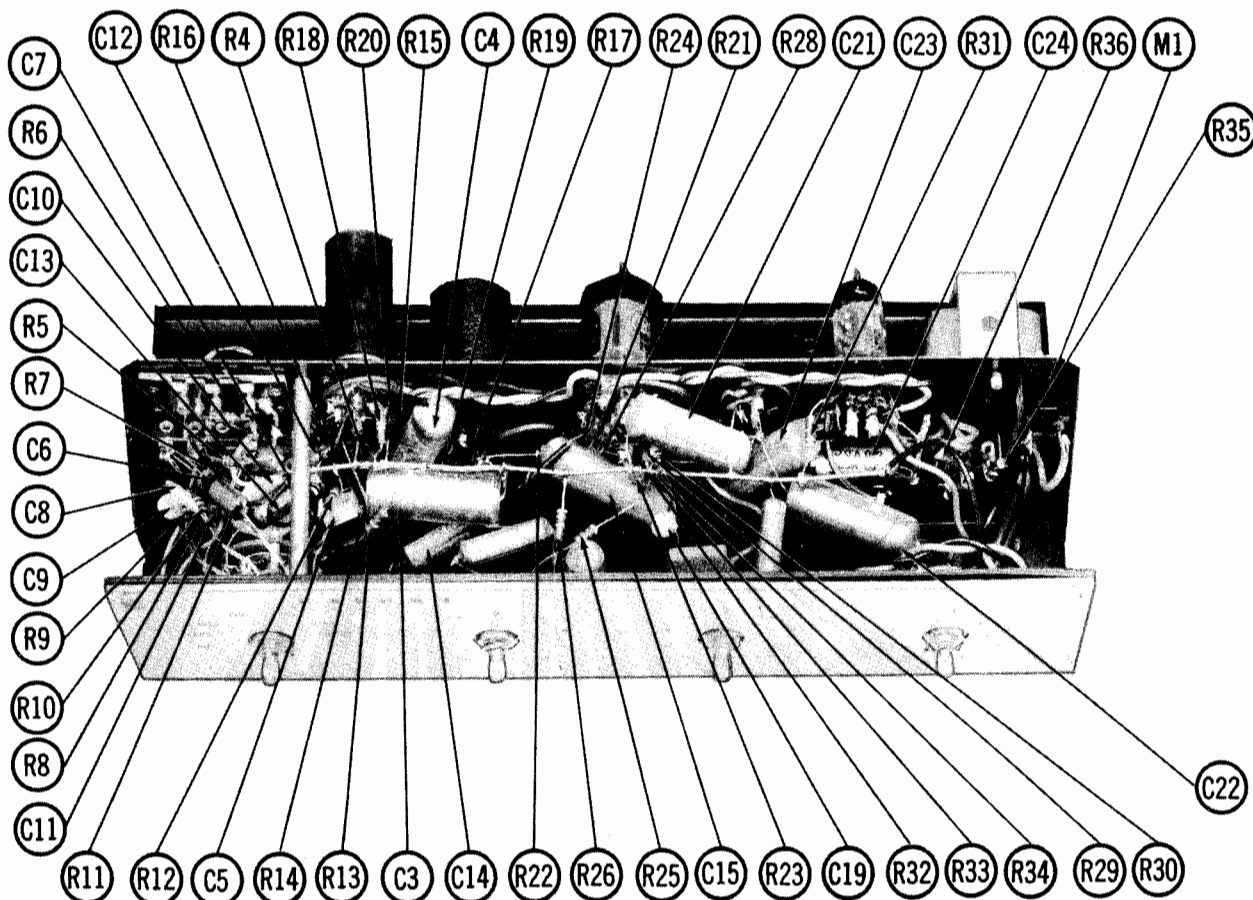
SELENIUM RECTIFIER

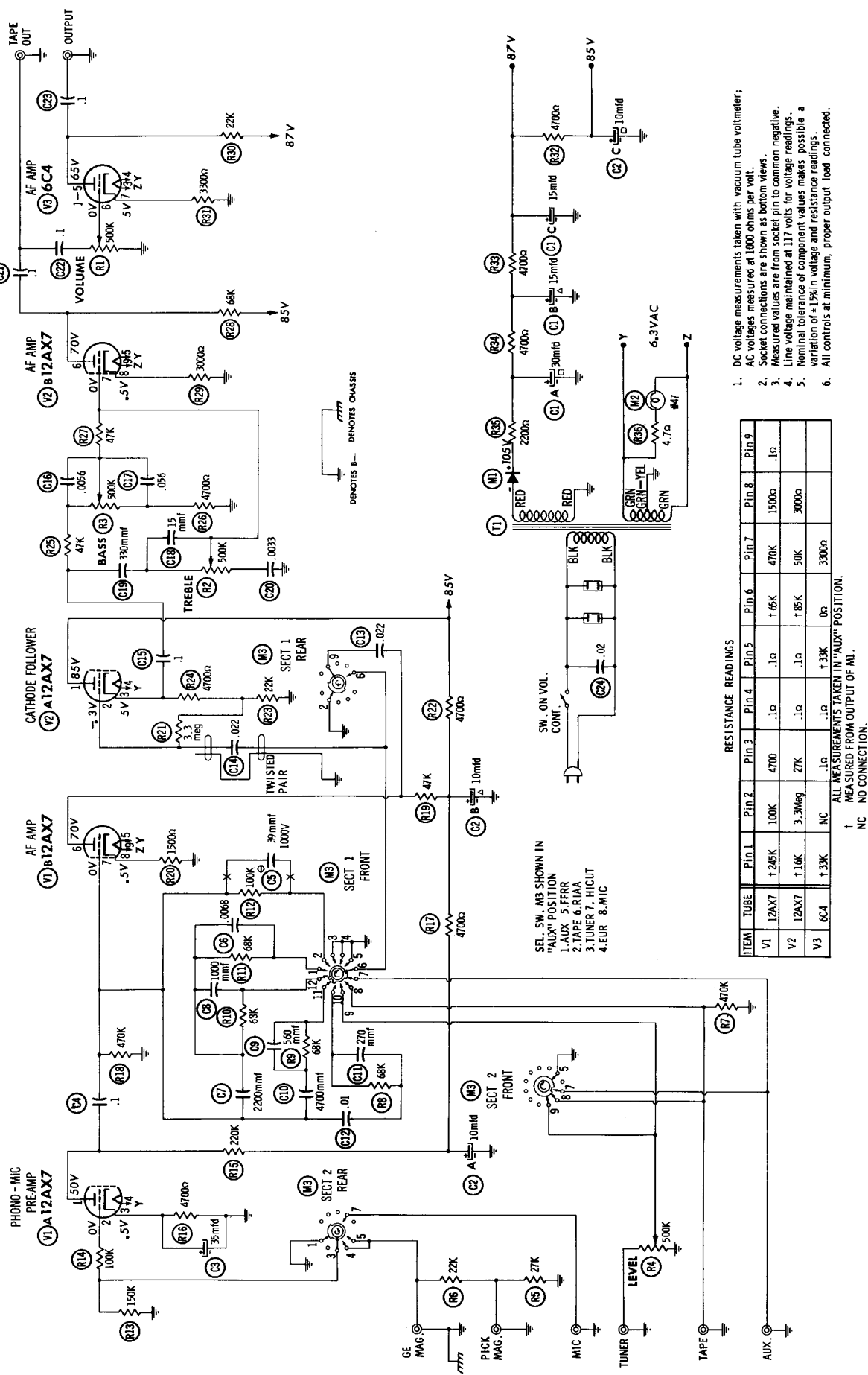
ITEM No.	RATING		REPLACEMENT DATA			NOTES
	CURRENT		KNIGHT PART No.	FEDERAL PART No.	RADIO RECEPTOR PART No.	
M1	.002A		JR-0022	1386	RG-050	8Y1

MISCELLANEOUS

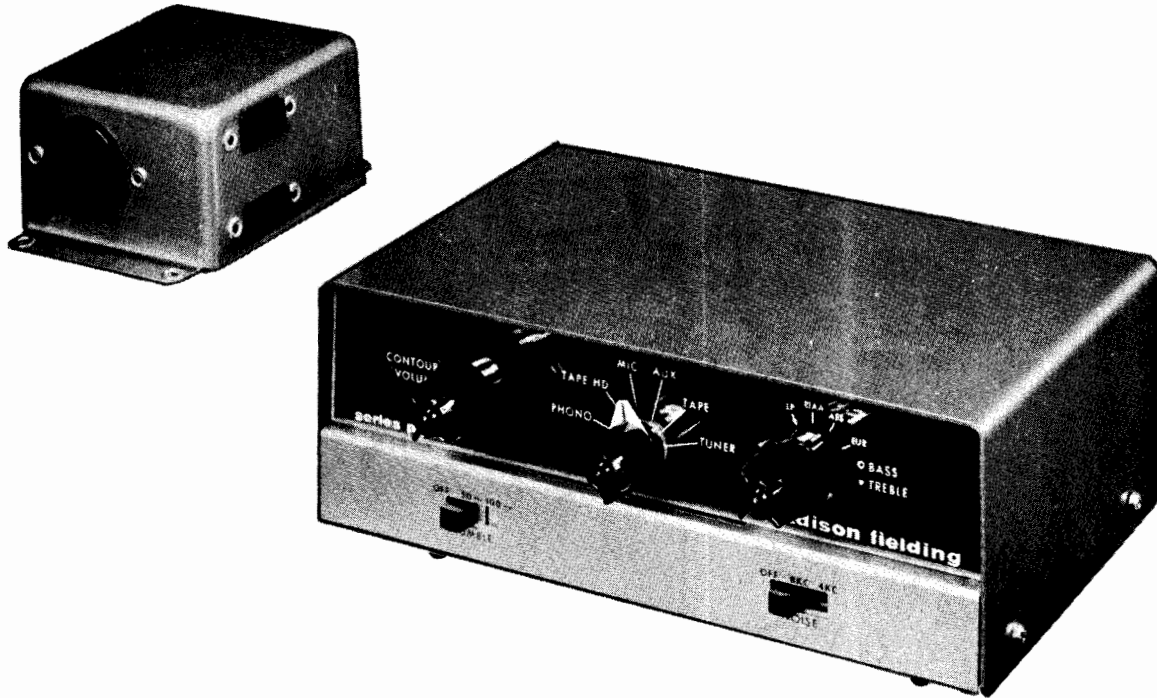
ITEM No.	PART NAME	KNIGHT PART No.	NOTES
M2	Dial Lamp		447
M3	Switch		Function Selector, 2 Gang, Wafer Type

CHASSIS—BOTTOM VIEW





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MADISON FIELDING
MODEL PR-45 "Transamp"

TRADE NAME	Madison Fielding Model PR-45 "Transamp"		
MANUFACTURER	Madison Fielding Corp., 863 Madison St., Brooklyn 21, N. Y.		
TYPE SET	AC Operated 6 Channel Preamplifier With Transistorized Input		
TUBES (One)	Type 12AX7/ECC83 AF Amplifier		
POWER SUPPLY	105-125 Volts AC-50/60 Cycles	RATING	.10 Amp. @ 117 Volts AC (6 Watts)

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PARTS LIST AND DESCRIPTIONS TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	ITEM No.	USE	TYPE
V1	AF Amplifier	12AX7/ECC83			

TRANSISTORS

ITEM No.	ORIG. TYPE	USE	REPLACEMENT DATA		NOTES
			CBS PART No.	SYLVANIA PART No.	
X1	2N35	AF Amplifier	2N439	2N35	
X2	2N35	AF Amplifier	2N439	2N35	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING CAP.	VOLT.	REPLACEMENT DATA				
			Madison Fielding PART No.	AEROVOX PART No.	CORNBELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.
C1A	20	200	CE202010				R2472 *
B	20	200					R2473 *
C	20	150					R2474 *
C2	2	15					R2475 *
C3	2	15					R2476 *
C4	150	2					R2477 *
C5	150	15					TE-1055
C6	150	20					TE-1055
C7	2	25					
C8	25	3					
C9	25	3					

* Non Catalog Item

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP.	VOLT.	REPLACEMENT DATA					NOTES
			Madison Fielding PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNBELL-DUBILIER PART No.	ERE PART No.	
C10	3500					LRD36		10%
C11	8700					LRD36		10%
C12	3500					BYB652	ED-02	10%
C13	20000					BYB652	ED-02	
C14	20000					CUB3P1	ED-02	
C15	1	200				DD-203	ED-0022	
C16	2200					DD-104	ED-0047	
C17	4700					DD-222	ED-0047	
C18	9					BYA10D22	GP-18	
C19	18					DD-472	ED-01	
C20	10000					D8-180	ED-01	
C21	10000					DD-103	ED-01	
C22	47					DD-103	GP-047	
C23	.22	200				D6-470	GP-047	

CONTROLS

ITEM No.	RATING RESIST. ANCE	WATTS	REPLACEMENT DATA				INSTALLATION NOTES
			Madison Fielding PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	
R1A	500K		RV10502				Volume Contour, Tap @ 25K & 50K
B	100K						
C	Switch						
R2A	470K		RV1002				Bass Treble, Tap @ 250K
R3A	500K		RV5043				Tuner Adjust
B	470K						
R4A	25K		RV2530				Phono & Low Level Adjust
B	5000						

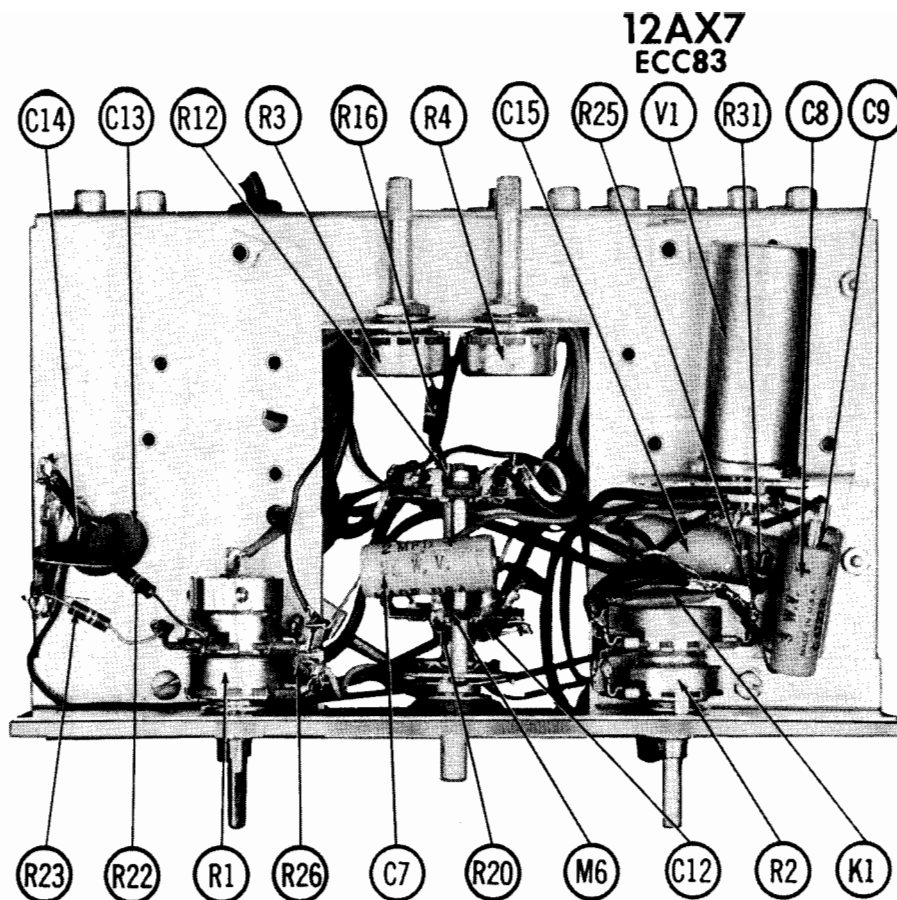
* Concentric Equivalent; K-2 Kit, Base Elements and Shafts: B11-137, P1-200 (Panel)

B19-137X, R1-205 (Rear)

▲ STA-LOC Equivalent FB55A, OS500, RU15DT54, IS125, US-41

■ STA-LOC Equivalent FB16L, OS500, RU55T254, IS125

CHASSIS—TOP VIEW



**12AX7
ECC83**

PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		Madison Fielding PART No.	NOTES
	OHMS	WATT		
R6	270K			
R7	150K			
R8	6800Ω			
R9	100K			
R10	120K			
R11	560Ω			
R12	390K			
R13	18K			
R14	100K			
R15	18K			
R16	100K			
R17	18K			
R18	18K			
R19	22K			
R20	22K			

TRANSFORMER (POWER)

ITEM No.	RATING			REPLACEMENT DATA			
	PRI.	SEC. 1	SEC. 2	Madison Fielding PART No.	Holidorsen PART No.	Merit PART No.	Stencor PART No.
T1	117V ④ .100A	155V ④ .002A	6.3V ④ .300A		TP1003		

COMPONENT COMBINATIONS

ITEM No.	USE	DESCRIPTION	Madison Fielding PART No.	REPLACEMENT DATA
K1	Tone Comp.	4700mmf, 4700mmf, 100mmf, 100K, 470K, 1000Ω		

RECTIFIERS

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	CURRENT (Measured)	Madison Fielding PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	
M1	.0018A	SRI001		CR28	

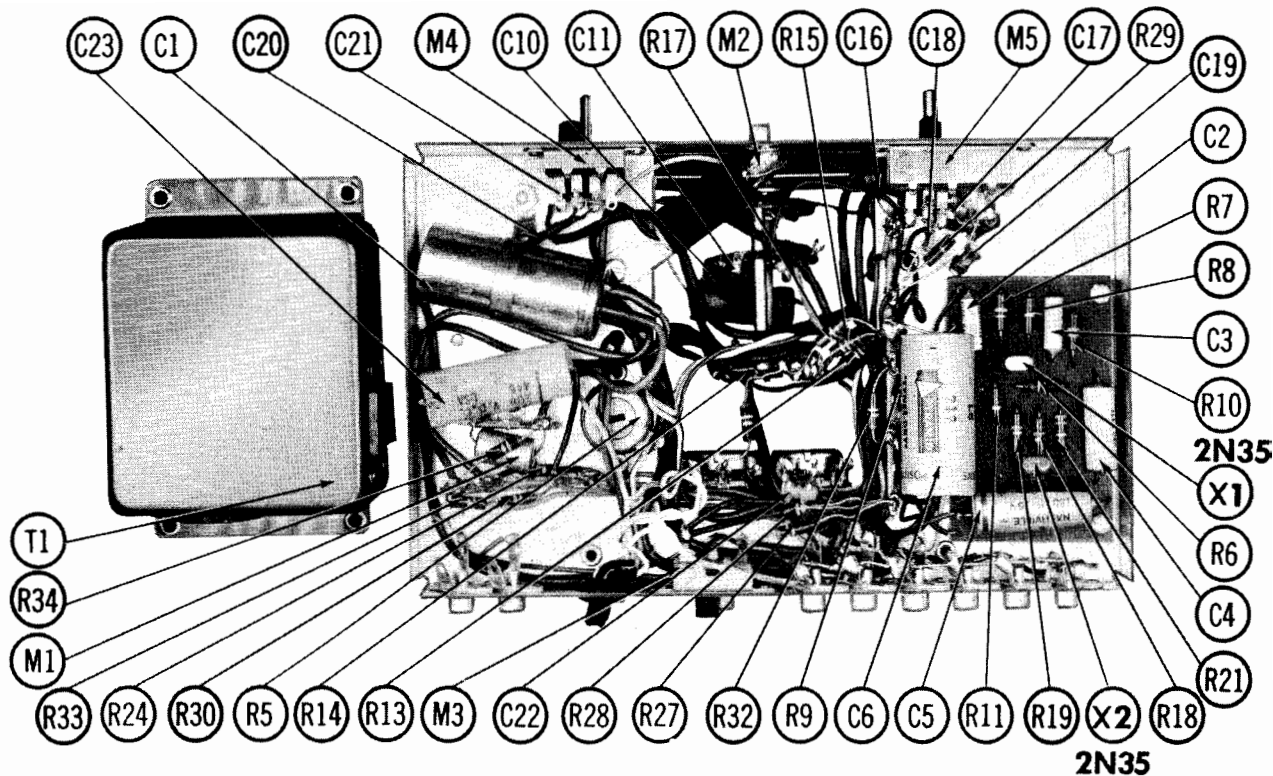
MISCELLANEOUS

ITEM No.	PART NAME	Madison Fielding PART No.	NOTES
M2	Pilot Lamp		#1847
M3	Switch	SSI007	Matched Function (Slide Type SPDT)
M4	Switch	SSI002	Rumble Filter (Slide Type DPDT)
M5	Switch	SSI006	Noise Filter (Slide Type DPDT)
M6	Switch	SF1002	Selector (Rotary Wafer Type)

WIRING DATA

General-use Unshielded Hook-up Wire	Use BELDEN No. 8530 (Solid) Available in Ten Colors
Power Cord	8524 (Stranded) Available in Ten Colors
Low-Loss Shielded Lead (Interconnecting)	1765-B (6 Ft. Length)
Phono Pick-up Arm Cable	1725-K (7½ Ft. Length)
	Use BELDEN No. 8401
	Use BELDEN No. 8430 (Two Conductor - Twisted)

CHASSIS—BOTTOM VIEW





**NEWCOMB
MODEL CO-1010**

TRADE NAME	Newcomb Model CO-1010
MANUFACTURER	Newcomb Audio Products Co., 6824 Lexington Ave., Hollywood 38, Calif.
TYPE SET	AC Operated 6 Channel 10 Watt Audio Amplifier
TUBES (Five)	Types 12AX7 Preamp. - AF Amp., 12AX7 AF Amp. - Phase Inv. (2) 6V6GT Output 6AX5GT Rectifier
POWER SUPPLY	110-120 Volts AC-60 Cycles
RATING	.55 Amp. @ 117 Volts AC (60 Watts)

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PARTS LIST AND DESCRIPTIONS TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Preamplifier-AF Amplifier	12AX7	
V2	AF Amplifier-Phase Inv.	12AX7	
V3	Output	6V6GT	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA					
	CAP.	VOLT.	NEWCOMB PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SPRAGUE PART No.
C1A	40	475	CE-36					
C1B	10	475						
C1C	10	475						
C2	25	50						
C2A	4	450	CE-1	PRS450V4	BR445	TC70	TD-4-450	FM-4504
C2B	4	450						TVA-1702

*Non Catalog Item

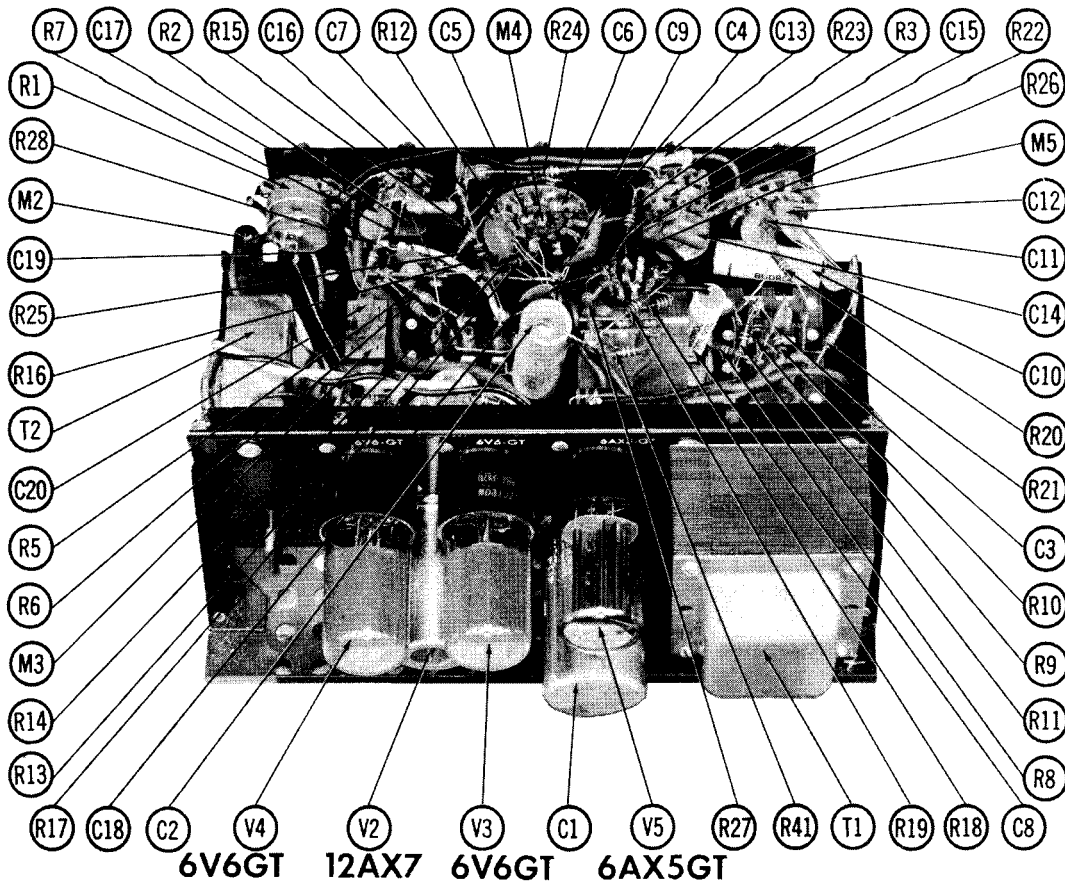
FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		NEWCOMB PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL DUBILIER PART No.	REPLACEMENT DATA			NOTES
	CAP.	VOLT					ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C3	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02	UC-5335	5HK-S2	
C4	350		CM-26	SI350	D6-351	LT6T35	GP-350	UC-531	5GA-T1	
C5	1000		CM-14	SI100	D6-101	LT6T1	GP-100	UC-531	5GA-T1	
C6	300		CM-15	SI300	D6-301	LT6T3	GP-300	UC-533	5GA-T3	
C7	1600		CM-52	BPD-0015	DD-152	BYA10D15	ED-0015	UC-5215	5HK-D15	
C8	600		CP-47	BPD-02	DD-203	CUB6S22	ED-02	GEM-6122	6TM-S22	
C9	10000		CM-32	BPD-01	DD-103	BYA6S1	ED-01	DCS11	5HK-S1	
C10	1	600	CP-51	p688N-1	DF-104	CUB6P1		GEM-601	6TM-P1	
C11	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02	UC-5347	5HK-S2	
C12	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02	UC-5347	5HK-S2	
C13	470		CM-25	SI470	D6-471	LT6T47	GP-470	UC-5215	5HK-D15	
C14	1500		CM-27	SI1500	D6-152	LT6D15	GP-1500	UC-5347	5GA-T47	
C15	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02	UC-5347	5HK-S2	
C16	470		CM-25	SI470	D6-471	LT6T47	GP-470	UC-5347	5GA-T47	
C17	10000		CM-32	BPD-01	DD-103	BYA6S1	ED-01	DCS11	5HK-S1	
C18	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02	UC-5347	5HK-S2	
C19	250		CM-22	BPD-00025	DD-251	LIOT25	ED-250	UC-5325	5GA-T25	
C20	10000		CM-32	BPD-01	DD-103	BYA6S1	ED-01	DCS11	5HK-S1	
C21	10000		CM-32	BPD-01	DD-103	BYA6S1	ED-01	DCS11	5HK-S1	
C22	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02	UC-5347	5HK-S2	
C23	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02	UC-5347	5HK-S2	
C24	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02	UC-5347	5HK-S2	
C25	100		CM-14	SI100	D6-101	LT6T1	GP-100	UC-531	5GA-T1	
C26	0.022	600	CP-47-1	BPD-02	DD-203	CUB6S22	ED-02	GEM-6122	6TM-S2	

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESIST-ANCE	WATTS	NEWCOMB PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	250K		RV-87-K	BT-53	A47F1-250K	Q13-130X		Loudness, Tap @ 100K
R2A	250K		RV-87-K	BT-53	A47F1-250K	Q13-130X		
R2B	Switch		RV-59-K	KB-1	SWE-12	76-1	UT-451	Treble, Tap @ 1.2Meg
R3A	2Meg		RV-57-K	KB-1	A47F3-2Meg	Q18-135X	Not Req.	Bass
R3B	5Meg		RV-57-K	KB-1	KSS-3	Not Req.	Not Req.	Bass
R4	100K		RV-75					Hum Balance (Wire Wound)



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	NEWCOMB PART No.	IRC PART No.	
R5	560K		RR-34	BTS-560K	
R6	560K		RR-34	BTS-560K	
R7	100K		RR-27	BTS-100K	
R8	56K		RR-25	BTS-56K	
R9	68K		RR-26	BTS-68K	
R10	100K		RR-27	BTS-100K	
R11	22K		RR-21	BTS-22K	
R12	330K		RR-32	BTS-330K	
R13	1.5Meg		RR-39	BTS-1.5Meg	
R14	270K		RR-31	BTS-270K	
R15	560K		RR-34	BTS-560K	
R16	470K		RR-33	BTS-470K	
R17	820K		RR-36	BTS-820K	
R18	18Meg		RR-140	BTS-18Meg	
R19	270K		RR-31	BTS-270K	
R20	560K		RR-34	BTS-560K	
R21	82K		RR-34	BTS-82K	
R22	560K		RR-34	BTS-560K	
R23	560K		RR-34	BTS-560K	
R24	560K		RR-34	BTS-560K	

Note 1. Some Versions May Use 560K In This Application (Part #RR-34).

TRANSFORMER (POWER)

ITEM No.	RATING			REPLACEMENT DATA		
	PRI	SEC. 1	SEC. 2	NEWCOMB PART No.	Halldorson PART No.	Meritt PART No.
T1	117VAC @ .55A	6.3VAC @ .072A	SEC. 3 @ 2.74A	TR-175		P-2951 ①

① Tape 5V Winding & Center Tap On 6.3V Winding.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA		NOTES
	PRI	SEC.	NEWCOMB PART No.	Halldorson PART No.	
T2	800Ω CT	16Ω Tap @ 8Ω	TR-185	21404	

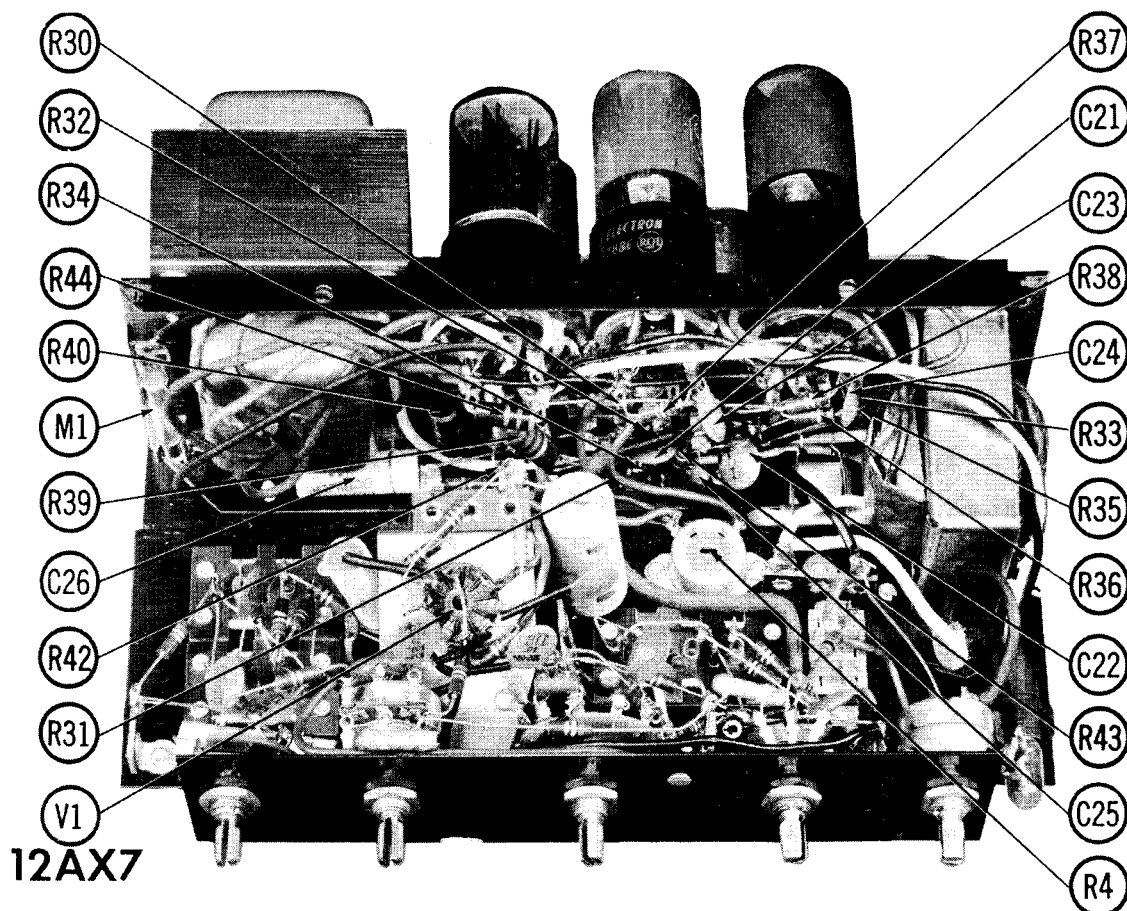
FUSES

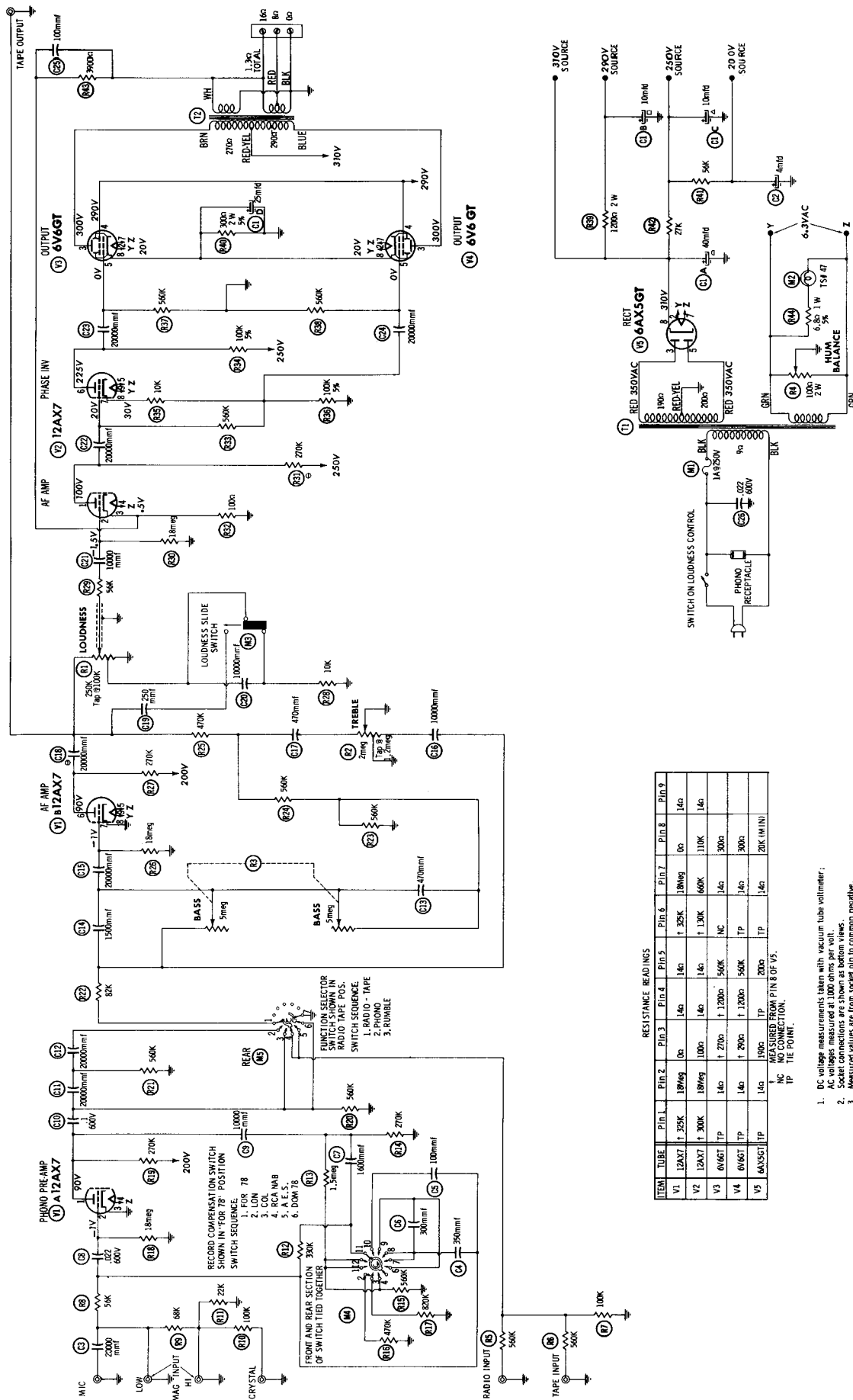
ITEM No.	TYPE	RATING	REPLACEMENT DATA		
			NEWCOMB PART No.	Halldorson PART No.	BUSS PART No.
M1	3AG	1A 250V S/B	FA-18	313001 (3AG1A)	MDLI 4405

MISCELLANEOUS

ITEM No.	PART NAME	NEWCOMB PART No.	NOTES
M2	Pilot Light		
M3	Switch	SY-5	
M4	Switch	SY-88	
M5	Switch	SY-90	

CHASSIS—BOTTOM VIEW





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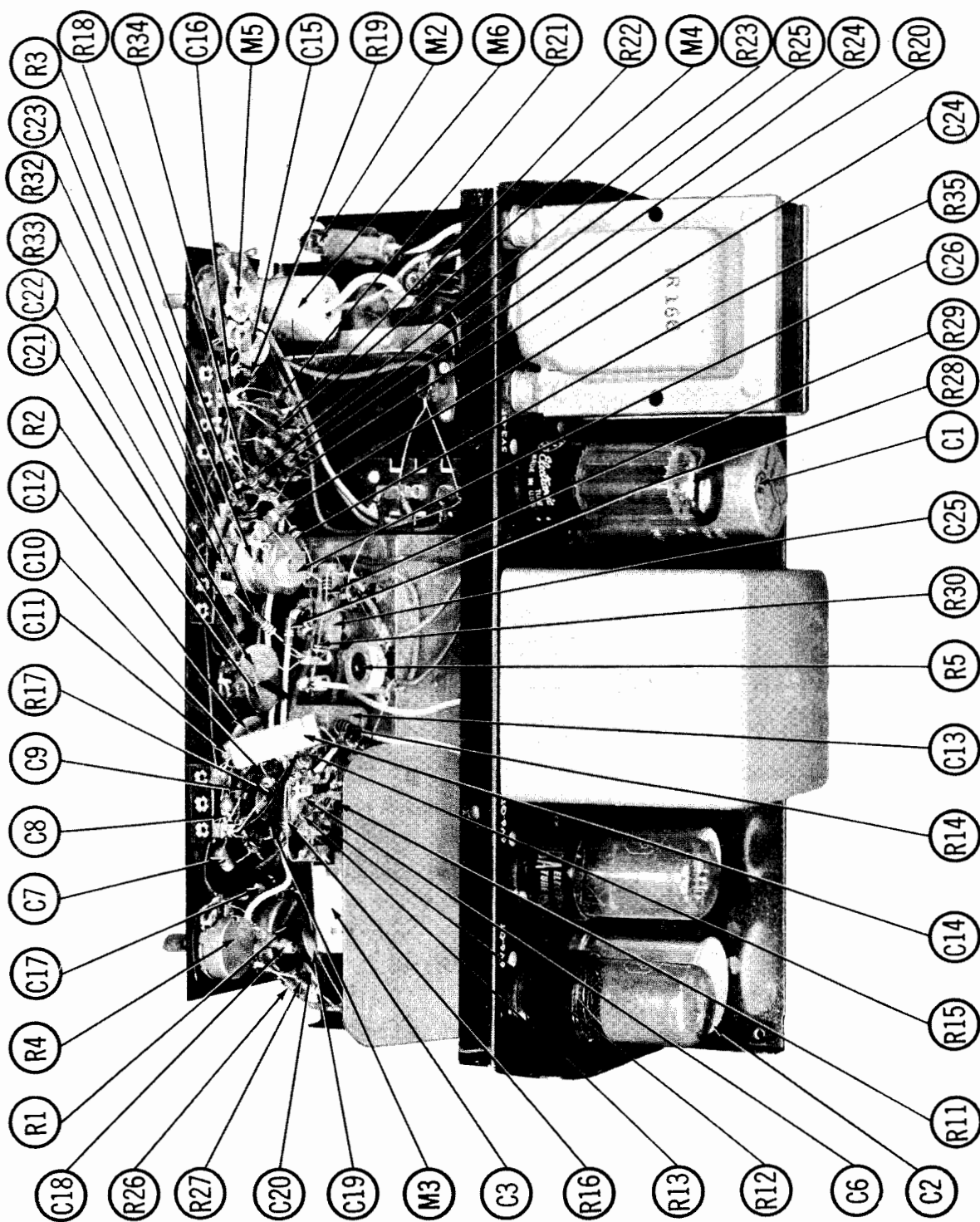
**NEWCOMB
MODEL CO-1012**

TRADE NAME	Newcomb Model CO-1012	
MANUFACTURER	Newcomb Audio Products Co., 6824 Lexington Ave., Hollywood 38, California	
TYPE SET	AC Operated 7 Channel 12 Watt Audio Amplifier	
TUBES (Six)	Types 12AX7 Mic-Phono Preamplifier, 6AV6 AF Amplifier, 12AX7 AF Amp. -Phase Inv. (2) 6V6GT Output, 5Y3GT Rectifier	
POWER SUPPLY	110-120 Volts AC-60 Cycles	RATING .64 Amp. @ 117 Volts AC (68 Watts)

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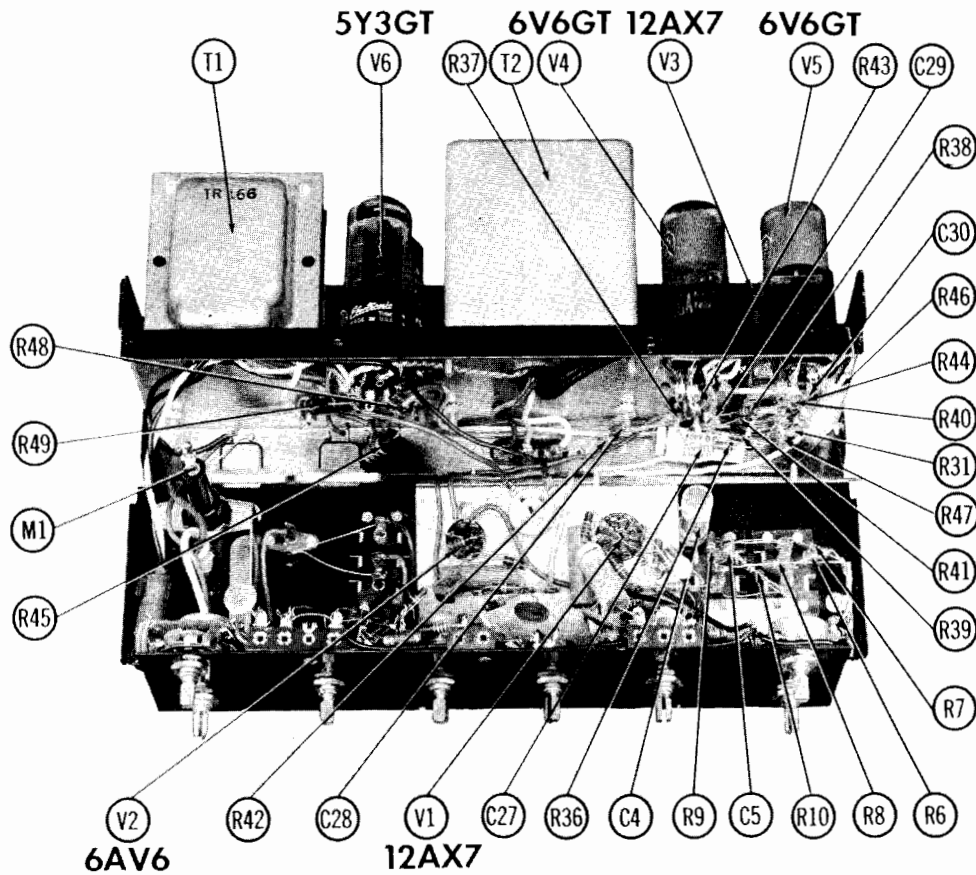
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CHASSIS TOP VIEW

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Mic-Phono Preamplifier	12AX7	
V2	A.F. Amplifier	6AV6	
V3	A.F. Amplifier-Phase Inv.	12AX7	
V4	Output	6V6GT	
V5	Output	6V6GT	
V6	Rectifier	5Y3GT	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA					
	CAP.	VOLT.	NEWCOMB PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.
C1A	60	500	CE-33	AFH3-49	BR3050	FP284	TD-20-500	Q-075
C1B	10	475			BR3050	TC82	TD-20-500	
C2A	20	475	CE-30			FP474	TD-25-30	Q-070
C2B	10	475				TC36		FM-0825
C3	25	50						
C4	4	450	CE-1	PRS450V4	BR445	TC70	TD-4-450	FM-4504

* Non Catalog Item.

FIXED CAPACITORS

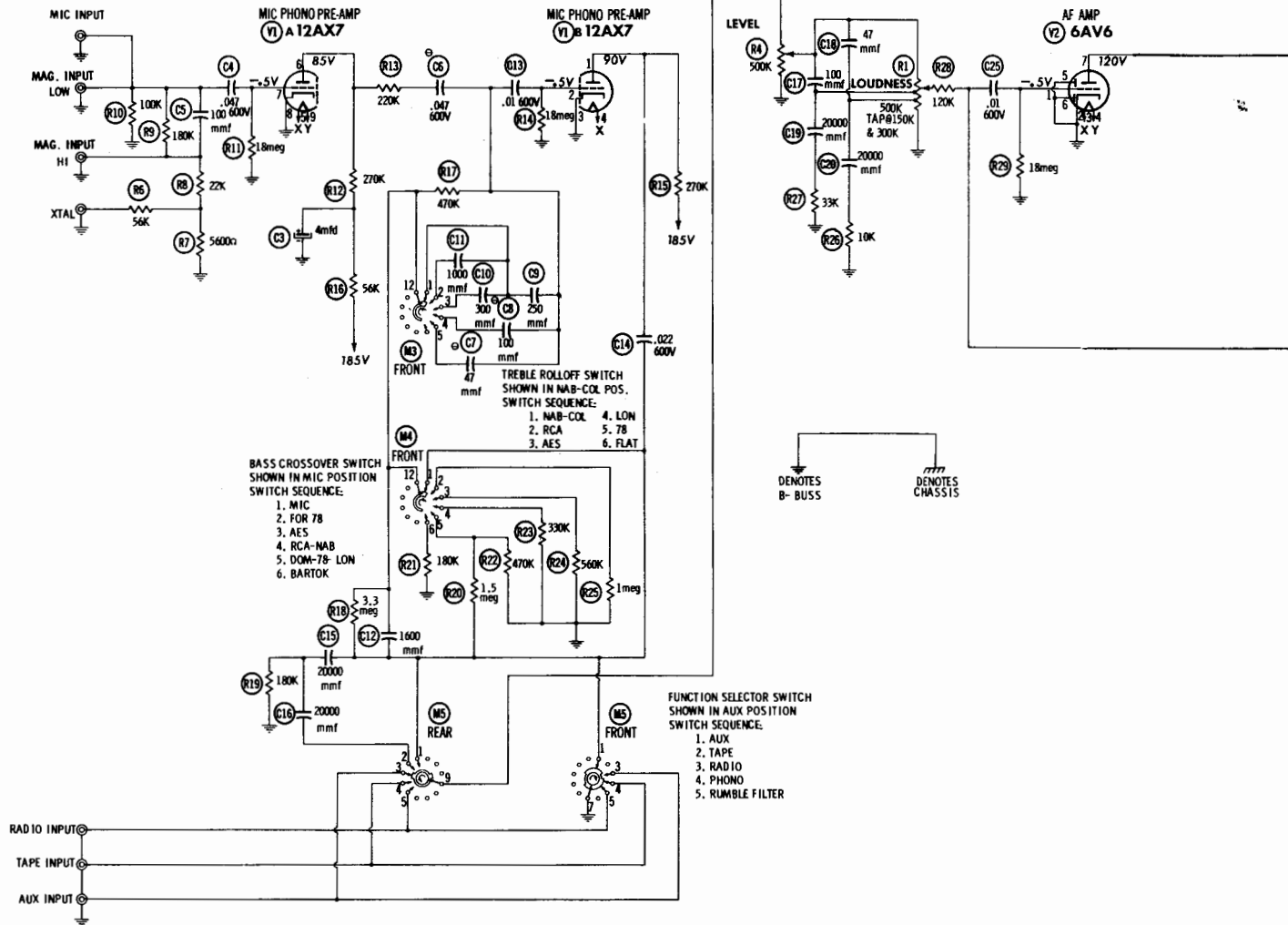
Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA						NOTES
	CAP.	VOLT.	NEWCOMB PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	ERNI PART No.	MALLORY PART No.	SPRAGUE PART No.	
C5	100	600	CM-14	BPD-05	DF-503	CUB6S47	GP-100	GEM-6147	Note 1 Note 2 Note 3
C6	100	600	CM-14	SI-100	DF-101	LT6T1	GP-100	5GA-T1	
C7	47	600	CM-3	BPD-05	DF-503	CUB6S47	GP-47	8TM-S47	
C8	100	600	CM-14	SI-47	D6-470	LT6T1	GP-100	5GA-Q47	
C9	250	600	CM-22	BPD-00025	DD-251	LI0T25	ED-250	5GA-T1	
C10	300	600	CM-15	SI-300	D6-301	LT6T3	GP-300	5GA-T25	
C11	1000	600	CM-38	SI-1000	D6-102	LT6T1	GP-1000	5GA-T3	
C12	1600	600	CM-52	BPD-0015	DD-162	BYA10D15	GP-1500	5HK-D1	
C13	01	600	CP-45	BPD-01	DD-103	CUB6S22	ED-02	8TM-SI	
C14	022	600	CP-47	BPD-02	DD-203	BYB6S22	ED-02	8TM-S22	
C15	20000	600	CM-35	BPD-02	DD-203	BYB6S22	ED-02	5HK-S2	
C16	20000	600	CM-35	BPD-02	DD-203	BYB6S22	ED-02	5HK-S2	
C17	100	600	CM-14	SI-100	D6-101	LT6T1	GP-100	5GA-T1	
C18	47	600	CM-3	SI-47	D6-470	LT6T1	GP-47	5GA-Q47	
C19	20000	600	CM-35	BPD-02	DD-203	BYB6S22	ED-02	5HK-S2	
C20	20000	600	CM-35	BPD-02	DD-203	BYB6S22	ED-02	5HK-S2	
C21	10000	600	CM-32	BPD-01	DD-103	BYA6S1	ED-01	5HK-S1	
C22	1000	600	CM-38	SI-1000	D6-102	LT6T1	GP-1000	5GA-T47	
C23	470	600	CM-25	SI-470	D6-471	LT6T1	GP-470	5GA-T47	
C24	470	600	CM-25	SI-470	D6-471	LT6T1	GP-470	5GA-T47	
C25	01	600	CP-45	BPD-01	DD-103	CUB6S1	ED-02	8TM-S1	
C26	20000	600	CM-35	BPD-02	DD-203	BYB6S22	ED-02	5HK-S2	
C27	047	600	CP-49	BPD-05	DD-503	CUB6S47	ED-05	5GA-Q3	
C28	30	600	CM-16	SI-30	DD-203	BYB6S22	ED-02	5HK-S2	
C29	20000	600	CM-35	BPD-02	DD-203	BYB6S22	ED-02	5HK-S2	

Note 1. Some versions may use .1 MFD @ 400V in this application.

Note 2. Some versions may use 100 MMF in this application.

Note 3. Some versions may use 150 MMF in this application.



SEE PARTS LIST FOR ALTERNATE
VALUE OR APPLICATION

PARTS LIST AND DESCRIPTIONS (Continued)

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA		INSTALLATION NOTES	
	RESISTANCE	WATTS	NEWCOMB PART No.	CLAROSTAT PART No.	MALLOTT PART No.	
R1A	500K	$\frac{1}{2}$	RV-71-K	ABT-180	UDT-285	Loudness, Tap @ 150K & 300K
R2A	2Meg	$\frac{1}{2}$	RV-59-K	AK-4	Not Req.	Treble, Tap @ 1.2Meg
R3A	5Meg	$\frac{1}{2}$	RV-57-K	A47F3-2Meg	Q18-139X	Not Req.
R4A	500K	$\frac{1}{2}$	RV-86-K	KSS-3	Not Req.	Bass Level
R5	100K	2	RV-75	B-59	Q11-133	Hum. Balance (Wire Wound)
				Not Req.	U50	
					Not Req.	

PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA			
	PRI.	SEC. 1	SEC. 2	SEC. 3	NEWCOMB PART No.	Meritt PART No.	Stancor PART No.	Triad PART No.
T1	117VAC	690VCT	5VAC	6.3VAC	TR-166	P8310 ①	PC8409 ①	24R02U ①
	③ .64A	③ .078A	③ 2A	③ 1.7A				

① Tape Center Tap On 6.3V Winding.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA				NOTES
	PRI.	SEC.	NEWCOMB PART No.	Meritt PART No.	Stancor PART No.	Triad PART No.	
T2	1300 Ω	16 Ω	TR-178				
	CT	Tap ③					
		8 Ω					

All wattages 1/2 watt, or less, unless otherwise listed.

RESISTORS

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	NEWCOMB PART No.	IRC PART No.	
R6	560 Ω		RR-25	BTS-58K	
R7	22K		RR-15	BTS-5600	
R8	180K		RR-21	BTS-22K	
R9	100K		RR-29	BTS-180K	
R10	100K		RR-27	BTS-100K	
R11	18Meg		RR-140	BTS-18Meg	
R12	270K		RR-31	BTS-270K	
R13	220K		RR-30	BTS-220K	
R14	18Meg		RR-140	BTS-18Meg	
R15	270K		RR-31	BTS-270K	
R16	56K		RR-25	BTS-56K	
R17	470K		RR-33	BTS-470K	
R18	3.3Meg		RR-42	BTS-3.3Meg	
R19	180K		RR-29	BTS-180K	
R20	1.5Meg		RR-39	BTS-1.5Meg	
R21	180K		RR-29	BTS-180K	
R22	470K		RR-33	BTS-470K	
R23	330K		RR-32	BTS-330K	
R24	560K		RR-34	BTS-560K	
R25	1Meg		RR-37	BTS-1Meg	
R26	10K		RR-18	BTS-10K	
R27	33K		RR-23	BTS-33K	
R28	120K		RR-28	BTS-120K	
R29	18Meg		RR-140	BTS-18Meg	
R30	100K		RR-27	BTS-100K	
R31	27K		RR-22	BTS-27K	
R32	330K		RR-32	BTS-330K	
R33	330K		RR-32	BTS-330K	
R34	560K		RR-34	BTS-560K	
R35	100K		RR-27	BTS-100K	
R36	100K 5%		RR-50	BTS-100K 5%	
R37	4700 Ω		RR-14	BTS-4700	
R38	560K		RR-34	BTS-560K	
R39	100K 5%		RR-50	BTS-100K 5%	
R40	100K 5%		RR-50	BTS-100K 5%	
R41	5600 Ω		RR-15	BTS-5600 Ω	
R42	22K		RR-21	BTS-22K	
R43	560K		RR-34	BTS-560K	
R44	560K		RR-34	BTS-560K	
R45	1200 Ω		RR-146	BTS-1200	
R46	300 Ω	2	RR-146	PW7-300	
R47	27K	5	RR-22	BTS-27K	
R48	27K		RR-22	BTS-27K	
R49	6.8 Ω	1	RR-149	BTS-27K	Note 1

Note #1. 2500.5 W Used in Some Versions (Part #RR-94).

FUSE

ITEM No.	TYPE	RATING	REPLACEMENT DATA			
			NEWCOMB PART No.	FUSE HOLDER	FUSE HOLDER	BUS PART No.
M1	3AG Slo/Blo	1A 250V	FA-4	313001 (3AG Slo/Blo 1A)	B41001	MDL1 HKP

MISCELLANEOUS

ITEM No.	PART NAME	NEWCOMB PART No.	NOTES	
			TS47	Power On-Off
M2	Pilot Light			
M3	Switch	SY-89		
M4	Switch	SY-89		
M5	Switch	SY-89		
M6	Switch	SY-91		

TS47
Treble Roll-Off, (Rotary Wafer Type)
Bass Cross-Over, (Rotary Wafer Type)
Function Selector (Rotary Wafer Type)



NEWCOMB
MODEL CO-1020

TRADE NAME	Newcomb Model CO-1020	
MANUFACTURER	Newcomb Audio Products Co., 6824 Lexington Ave., Hollywood 38, Calif.	
TYPE SET	AC Operated 7 Channel 20 Watt Audio Amplifier	
TUBES (Six)	Types 12AX7 Preamplifier, 6AV6 AF Amplifier, 12AX7 AF Amp. -Phase Inv., (2) 6L6GB Output, 5U4GA Rectifier	
POWER SUPPLY	110-120 Volts AC-60 Cycles	RATING .96 Amp. @ 117 Volts AC (105 Watts)

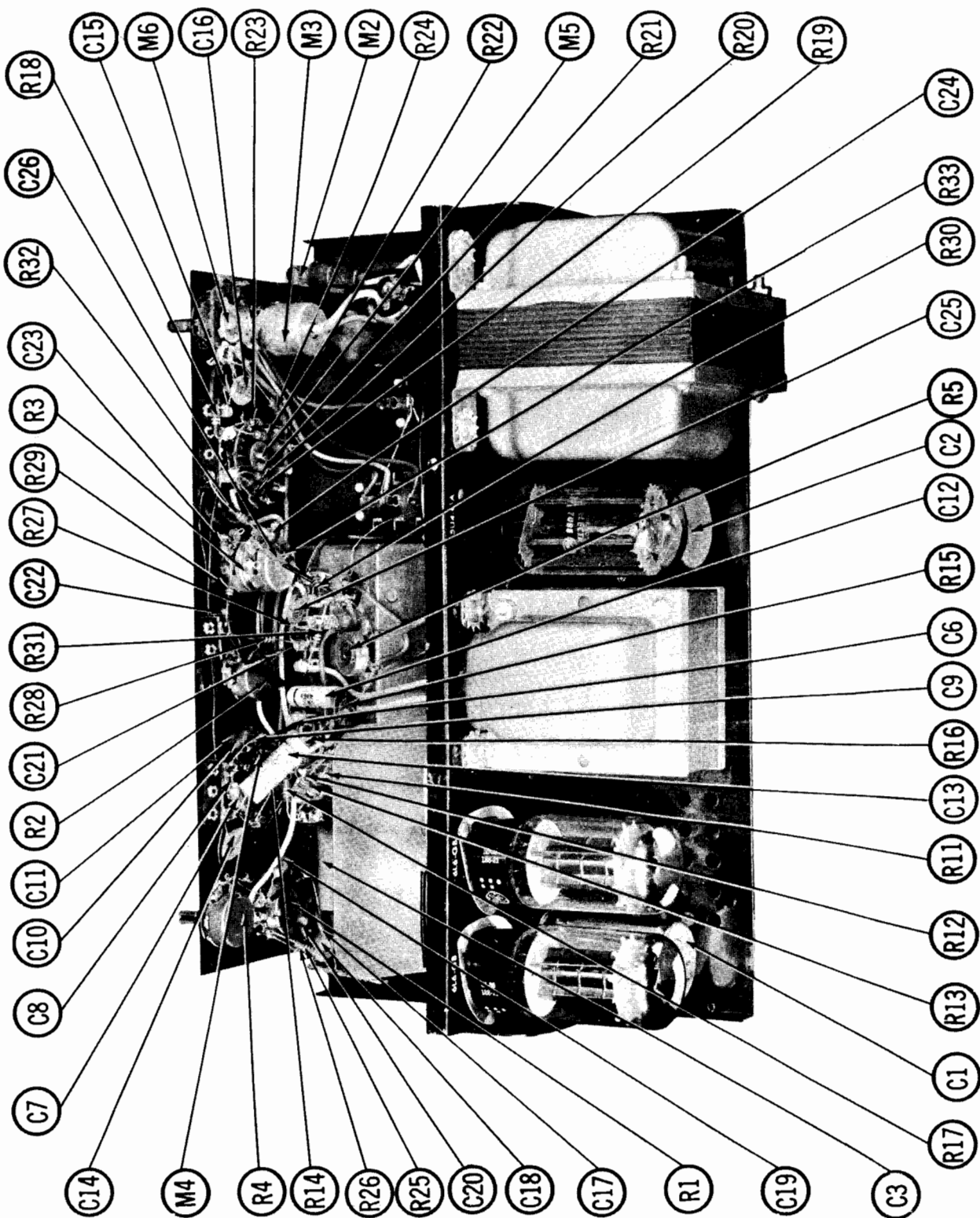
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CHASSIS TOP VIEW

PARTS LIST AND DESCRIPTIONS TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Preamplifier	12AX7	
V2	AF Amplifier	6AV6	
V3	AF Amp. -Phase Inv.	12AX7	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA			
	CAP.	VOLT.	NEWCOMB PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	SPRAGUE PART No.
C1A	.60	500	CE-33	AFH3-53	D0880	R2409 *
C2A	.20	475	CE-30	AFH4-19-10	FP474.5	R2405 *
C3	.25	30				
C4	.450	450	CE-1	PRS450V4	BR445	TVA-1702

* Non catalog item

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA						NOTES
	CAP.	VOLT.	NEWCOMB PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	EMI PART No.	MALLORY PART No.	
C4	.047	800	CM-14	SI 100	D6-101	L76T1	GP-100	UC-531	5GA-T1
C5	.047	800	CP-49	BPD-05	DF-503	CUB6S47	GP-100	GEM-6147	6TM-S47
C6	.047	800	CM-3	SI 47	D6-470	CUB6S47	GP-47	GEM-6147	6TM-S47
C7	.100	800	CM-14	SI 100	D6-101	L76T1	GP-100	UC-5447	5GA-Q47
C8	.100	800	CM-22	SI 250	D6-251	L76T1	GP-250	UC-531	5GA-T1
C9	.100	800	CM-26	SI 350	D6-351	L76T1	GP-350	UC-5325	5GA-T25
C10	.100	800	CM-38	SI 1000	D6-102	L76T1	GP-1000	UC-5335	5GA-T35
C11	.100	800	CP-45	BPD-01	D6-103	CUB6S1	GP-1000	DCS21	5HK-D1
C12	.01	800	CP-45	BPD-01	DD-103	CUB6S22	ED-02	GEM-611	6TM-S1
C13	.022	800	CP-47	BPD-02	DD-152	L10D15	ED-02	GEM-6122	6TM-S22
C14	.022	800	CM-32	BPD-02	DD-103	BYB6S2	ED-02	UC-5215	5HK-D15
C15	.022	800	CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2
C16	.022	800	CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2
C17	.022	800	CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2
C18	.022	800	CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2
C19	.022	800	CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2
C20	.022	800	CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2
C21	.022	800	CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2
C22	.022	800	CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2
C23	.022	800	CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2
C24	.022	800	CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2
C25	.022	800	CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2
C26	.022	800	CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2
C27	.047	800	CP-49	BPD-05	DF-503	CUB6S47	GP-100	UC-531	5GA-T1
C28	.047	800	CP-49	BPD-05	DF-503	CUB6S47	GP-100	UC-531	5GA-T1
C29	.1	800	CP-52	P888N-1	DF-104	CUB6P1	GP-100	GEM-6147	6TM-S47
C30	.1	800	CP-52	P888N-1	DF-104	CUB6P1	GP-100	GEM-601	6TM-P1
C31	.250	800	DM-22	BPD-00025	D6-251	L76T25	GP-250	UC-5325	5GA-T25

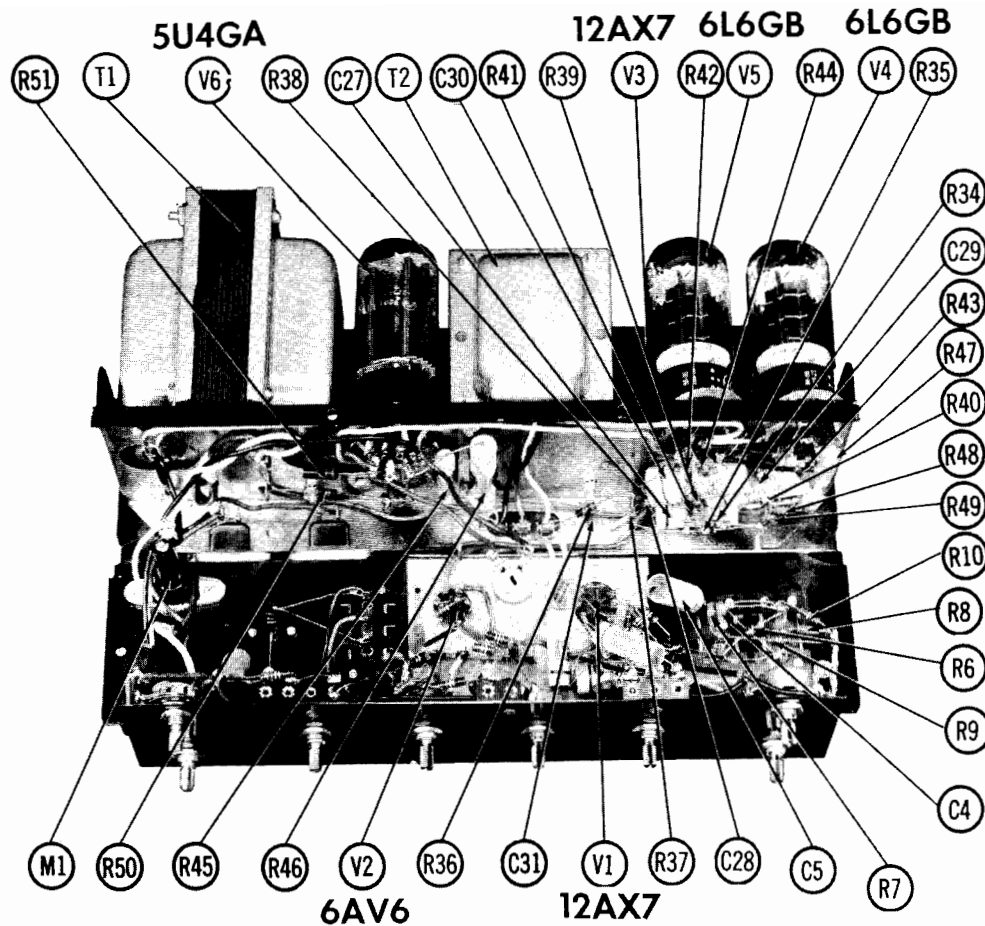
Note 1. Some versions may use .1MFD in this application (Part #CP-52)

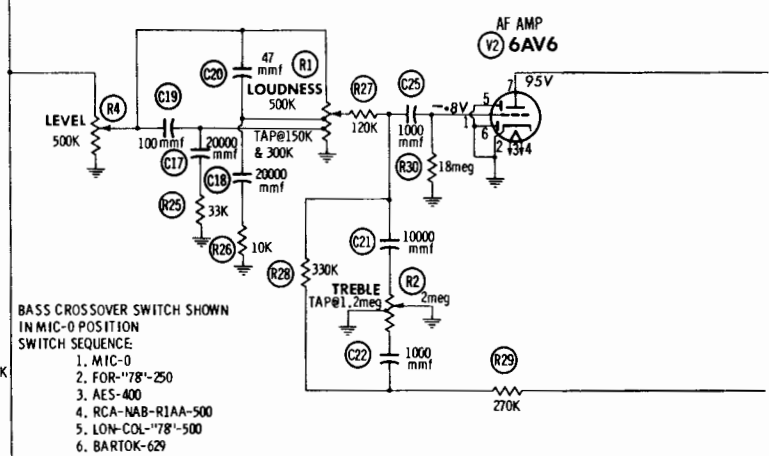
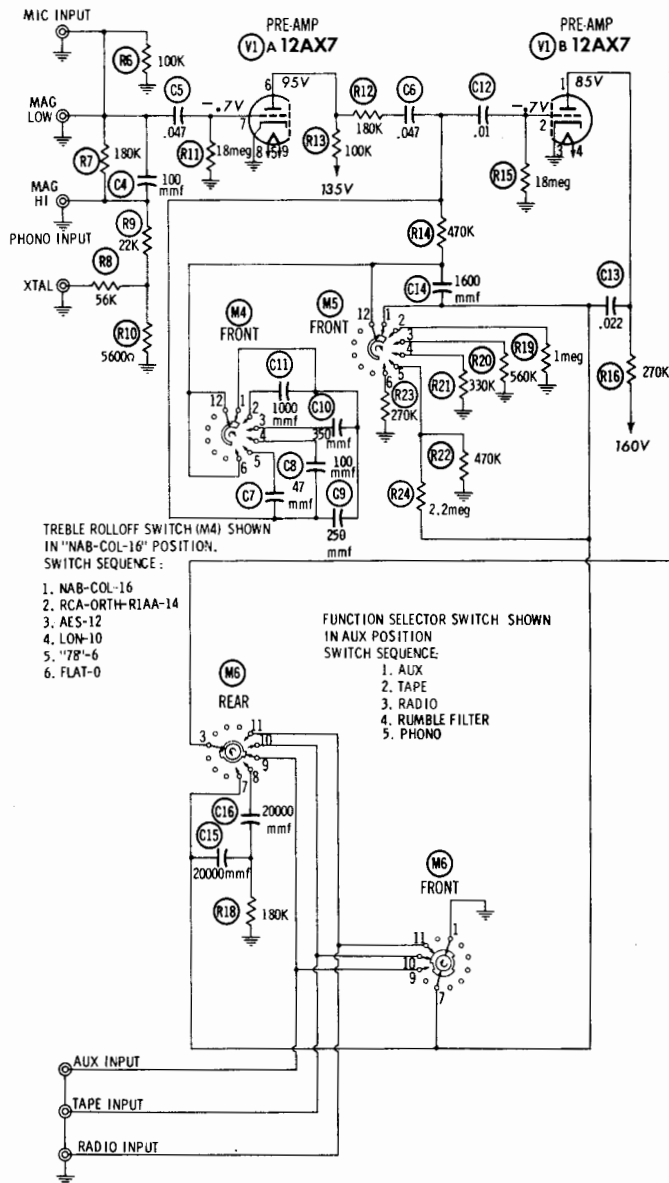
Note 2. Some versions may use 300MMMF in this application

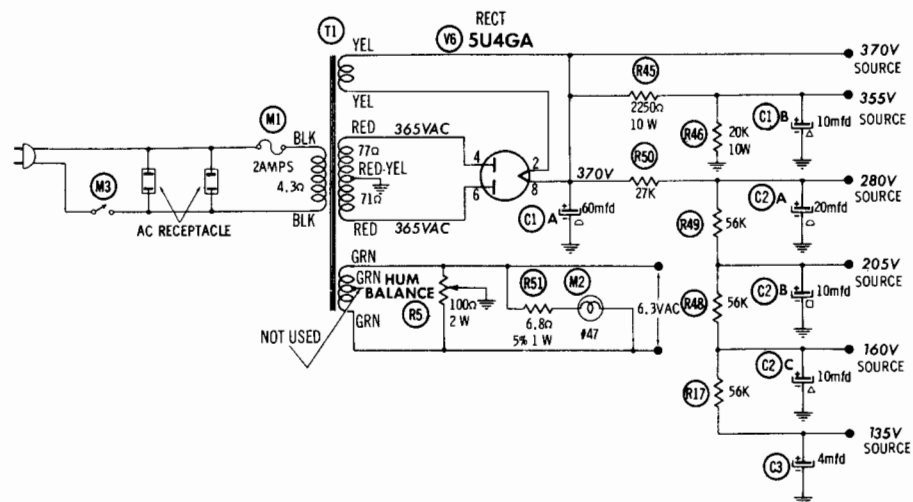
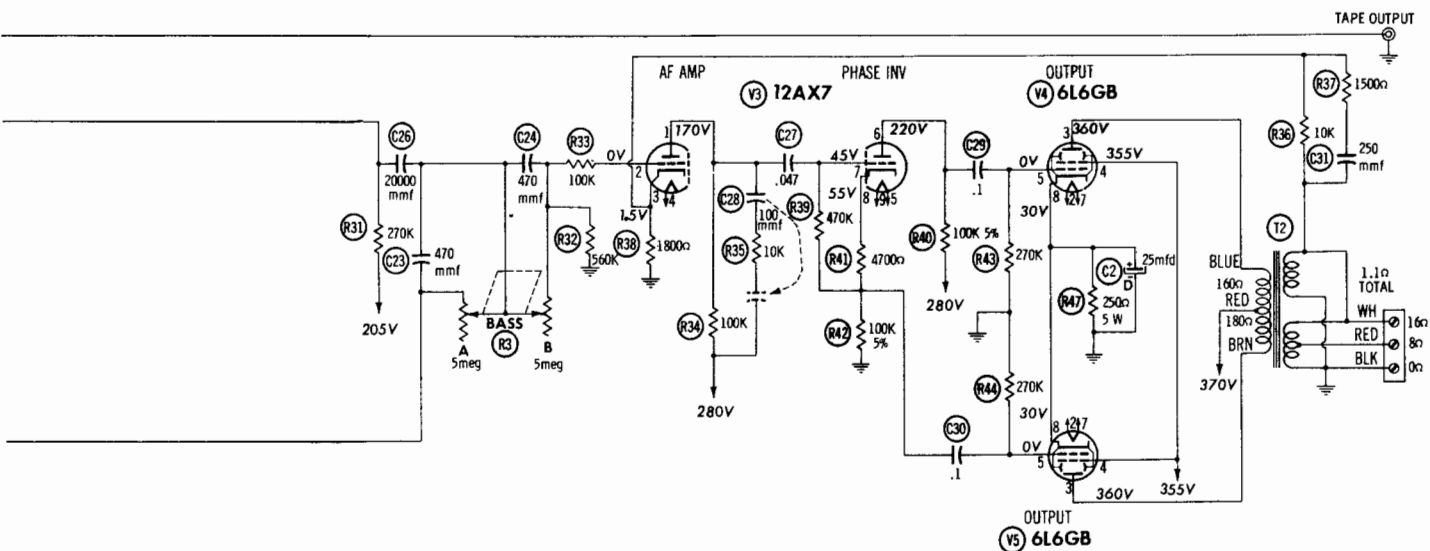
CONTROLS

ITEM No.	RATING		REPLACEMENT DATA				INSTALLATION NOTES
	RESIST. ANCE	WATTS	NEWCOMB PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	MALLORY PART No.	
R1	500K		RV-71-K		A47F3-2Meg	UDT-285	Loudness, Tap@ 150K & 300K
R2A	2Meg		RV-59-K		KSS-3	UT-451	Treble, Tap@ 1.2Meg
R3A	5Meg		RV-57-K			Not req.	Bass
R4A	5Meg		RV-86-K		A47-500K-S	U50	Level
R5	100K	2	RV-75		KSS-3	Not req.	Hum Balance

CHASSIS—TOP VIEW







RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7	† 410K	18Meg	0Ω	26Ω	26Ω	† 295K	18Meg	0Ω	26Ω
V2	6AV6	18Meg	0Ω	26Ω	26Ω	0Ω	0Ω	† 355K		
V3	12AX7	† 127K	660K	1800Ω	26Ω	26Ω	† 127K	570K	100K	26Ω
V4	6L6GB	TP	26Ω	† 160Ω	† 2250Ω	270K	NC	26Ω	250Ω	
V5	6L6GB	TP	26Ω	† 180Ω	† 2250Ω	270K	TP	26Ω	250Ω	
V6	5U4GB	TP	20K(Min)	TP	77Ω	TP	71Ω	TP	20K(Min)	

† MEASURED FROM PIN 8 OF V6
 NC NO CONNECTION
 TP TIE POINT

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING			REPLACEMENT DATA			NOTES
	OHMS	WATT		NEWCOMB PART No.	IRC PART No.		
R6	100K			RR-27	BTS-100K		
R7	180K			RR-28	BTS-180K		
R8	56K			RR-25	BTS-56K		
R9	22K			RR-21	BTS-22K		
R10	5600Ω			RR-15	BTS-5600		
R11	18Meg			RR-140	BTS-18Meg		
R12	180K			RR-29	BTS-180K		
R13	100K			RR-27	BTS-100K		
R14	470K			RR-33	BTS-470K		
R15	18Meg			RR-140	BTS-18Meg		
R16	270K			RR-31	BTS-270K		
R17	56K			RR-25	BTS-56K		
R18	180K			RR-29	BTS-180K		
R19	1Meg			RR-37	BTS-1Meg		
R20	560K			RR-34	BTS-560K		
R21	330K			RR-32	BTS-330K		
R22	470K			RR-31	BTS-470K		
R23	270K			RR-40	BTS-270K		
R24	2.2Meg			RR-23	BTS-2.2Meg		
R25	33K			RR-18	BTS-33K		
R26	10K			RR-28	BTS-10K		
R27	120K			RR-28	BTS-120K		
R28	330K			RR-32	BTS-330K		

CHASSIS—BOTTOM VIEW

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA					NOTES
	PRI.	SEC.	NEWCOMB PART No.	Holldorson PART No.	Merit PART No.	Stancor PART No.	Triad PART No.	
T2	6300Ω	18Ω CT	TR-181	Z1403 ①	A-3130 ①	A-3307 ①	22S88 ①	S-60A ①

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA				
			NEWCOMB PART No.	HOLDER	LITTELFUSE PART No.	HOLDER	BUSS PART No.
M1	3AG	2A	F A-5		312002.	341001	AGC2

MISCELLANEOUS

ITEM No.	PART NAME	NEWCOMB PART No.	NOTES
M2	Pilot Light Switch		
M3	Switch		
M4	Switch		
M5	Switch		
M6	Switch		

TRANSFORMER (POWER)

ITEM No.	RATING			REPLACEMENT DATA			NOTES
	PRI.	SEC. 1	SEC. 2	SEC. 3	NEWCOMB PART No.	Holldorson PART No.	
T1	117VAC	720VCT	5V	6.3VCT	TR-118		

① Tap Center Tap On 6.3V Winding.

② Drill New Mounting Holes.



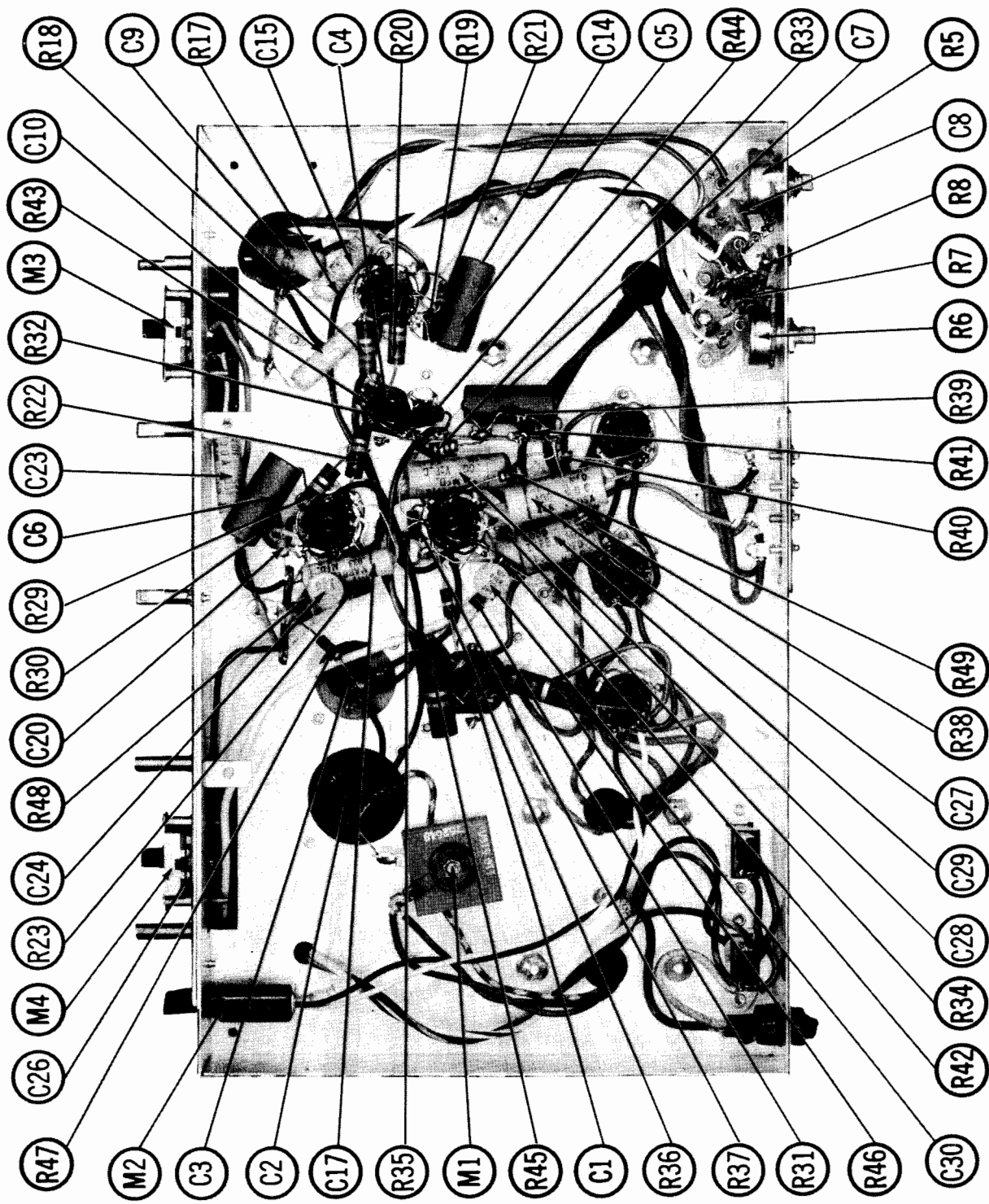
PILOT MODEL
AA-903B

TRADE NAME	Pilot Model AA-903B		
MANUFACTURER	Pilot Radio Corp., 37-06 36th St., Long Island City 1, N. Y.		
TYPE SET	AC Operated 5 Channel Audio Amplifier		
TUBES (Six)	Types 12AX7 Phono Preamplifier, 12AX7 AF Amplifier, 12AX7 AF Amp. - Phase Inv., (2) EL84 (or) 6BQ5 Output, EZ81 (or) 6CA4 Rectifier		
POWER SUPPLY	105-120 Volts AC-60 Cycles	RATING	.72 Amp. @ 117 Volts AC (71 Watts)

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CHASSIS-BOTTOM VIEW

PARTS LIST AND DESCRIPTIONS TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Phono Preamplifier	12AX7	
V2	AF Amplifier	12AX7	
V3	AF Amp. - Phase Inv.	12AX7	

Note 1. Alternate Type 6BX5

ITEM No.	USE	TYPE	NOTES
V4	Output	EL84	Note 1
V5	Output	EL84	Note 1
V6	Rectifier	EZ81	Note 2

Note 2. Alternate Type 6CA4

ELECTROLYTIC CAPACITORS

ITEM No.	RATING CAP.	VOL.	REPLACEMENT DATA				
			PILLOT PART No.	AEROVOX PART No.	CORNELL-DUBIER PART No.	MALLORY PART No.	SPRAGUE PART No.
C1A	20	350	24-153	AFH4-14	D0130	FP444	TMQ-12
C1B	20	350					
C1C	20	350					
C2	500	25	24-152	AFH1-08	A0120	WP057	TMS-10
C3	100	25	24-154	AFH1-21	XA0241	WP055	TMS-9
C4A	410	350	24-151	AFH3-28	C0220	FP259	TMT-28
C4B	410	350					
C5	25	25	24-50	PRS25V25	BBR25-25	TC26	TD-25-25
C6	25	25	24-50	PRS25V25	BBR25-25	TC26	TD-25-25
C7	25	25	24-50	PRS25V25	BBR25-25	TC26	TD-25-25

① Not used in some versions.

FIXED CAPACITORS

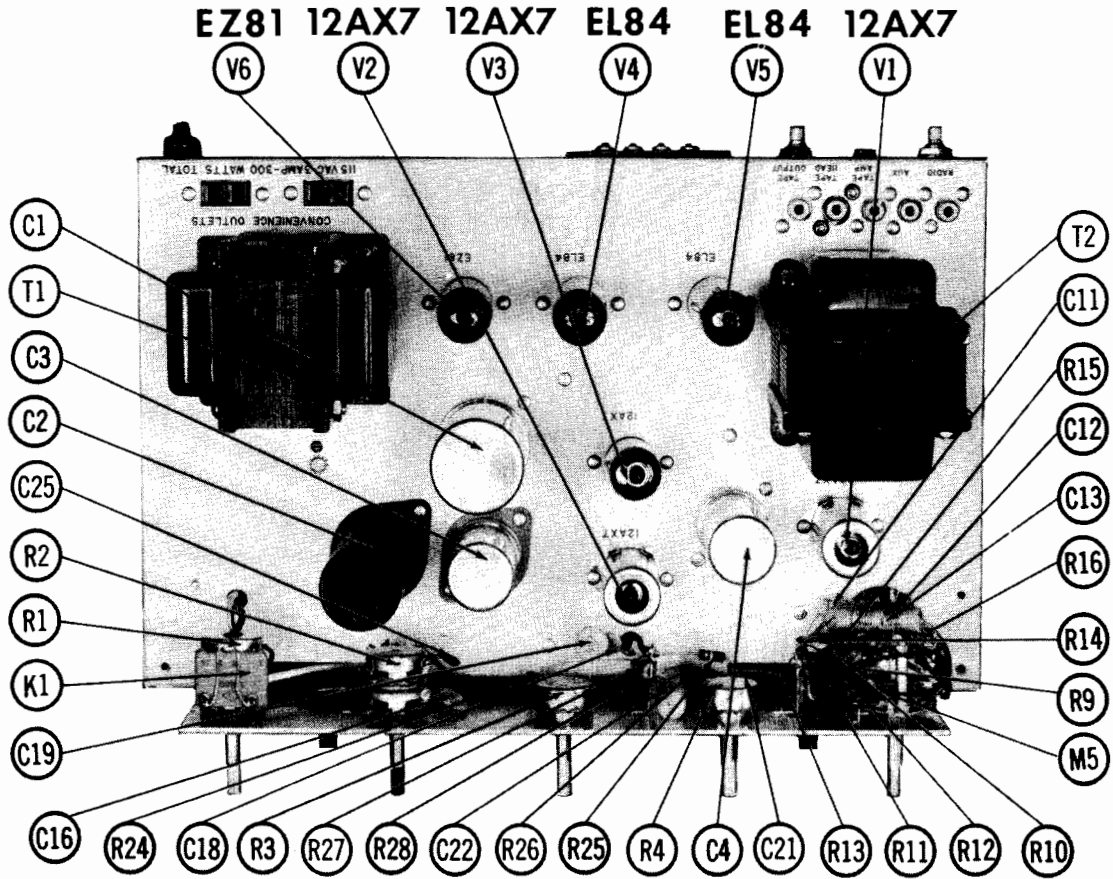
Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

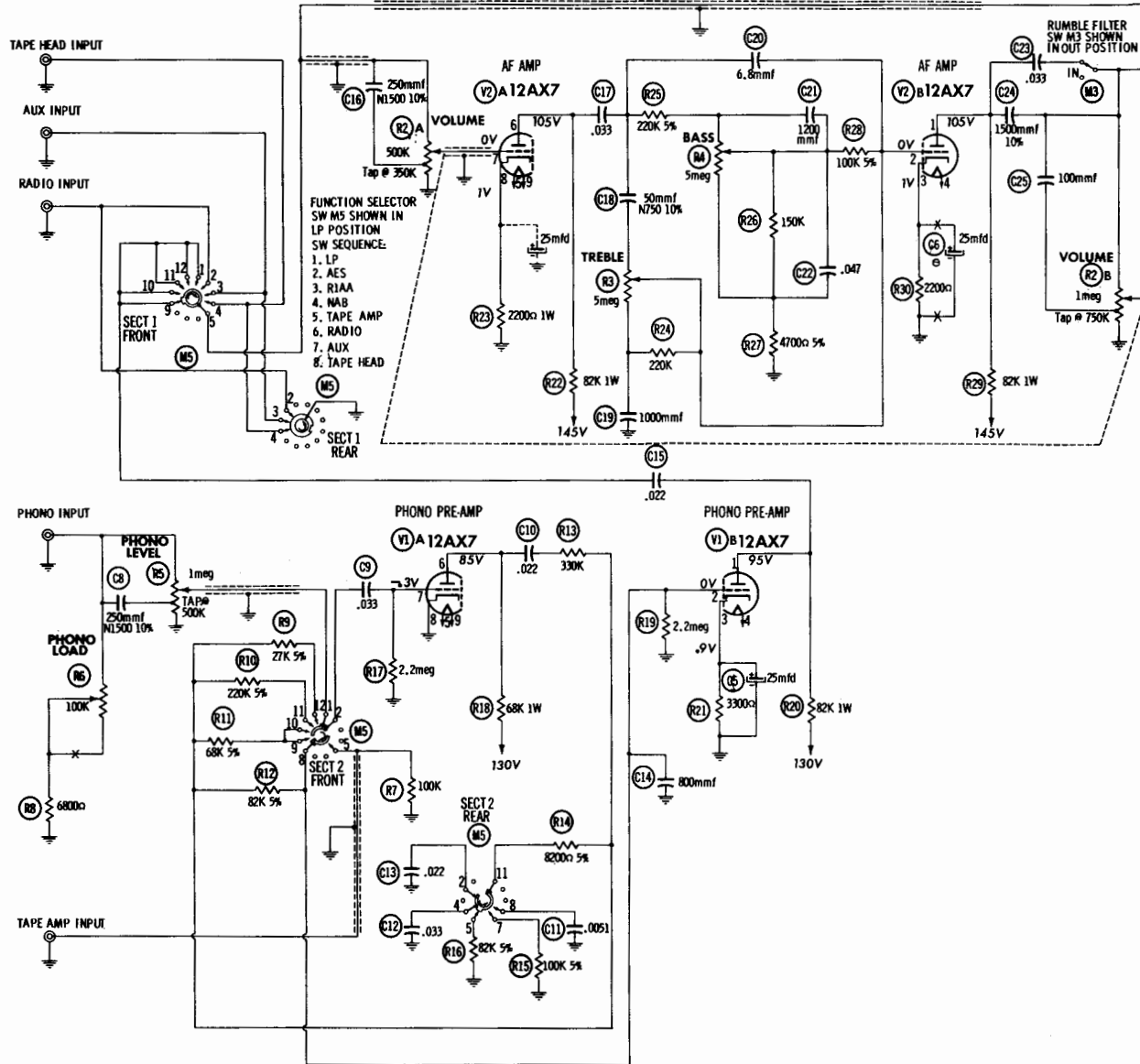
ITEM No.	RATING CAP.	VOL.	REPLACEMENT DATA					NOTES
			PILLOT PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBIER PART No.	ERIE PART No.	
C8	250	400		BPD-03	DF-303	CUB4S33	ED-02	6TM-833
C9	0.33	400		BPD-02	DD-203	CUB4S22	GP-5000	4TM-822
C10	0.22	400		BPD-05	D6-502	CUB4D5		8TM-D5
C11	0.051	400		BPD-03	DF-303	CUB4S33		8TM-S33
C12	0.33	400		BPD-02	DD-203	CUB4S22		4TM-S22
C13	0.22	400		BPD-0008	DD-801	L1078		5GA-T8
C14	800	400		BPD-02	DD-203	CUB4S22		4TM-S22
C15	0.22	400		BPD-03	DF-303	CUB4S33		6TM-S33
C16	250	400		BPD-01	DD-102	CUB4D1		5HK-D1
C17	0.33	400		BPD-01	DD-102	CUB4D1		5HK-D1
C18	50	400		BPD-01	DD-102	CUB4D1		5HK-D1
C19	1000	400		BPD-01	DD-102	CUB4D1		5HK-D1
C20	6.8	400		BPD-01	DD-102	CUB4D1		5HK-D1
C21	1200	400		BPD-05	D6-502	CUB4D5		8TM-D5
C22	0.47	400		BPD-03	DF-303	CUB4S33		4TM-S33
C23	0.33	400		BPD-03	DF-303	CUB4S33		4TM-S33
C24	1500	400		BPD-0001	DD-101	L1071		5GA-T1
C25	1500	400		BPD-0001	DD-101	L1071		5GA-T1
C26	1500	400		BPD-0001	DD-101	L1071		5GA-T1
C27	1	200		BPD-0001	DD-101	L1071		5GA-T1
C28	1	200		BPD-0001	DD-101	L1071		5GA-T1
C29	1	200		BPD-0001	DD-101	L1071		5GA-T1
C30	150	400		BPD-0001	DD-101	L1071		5GA-T1

CONTROLS

ITEM No.	RATING RESIST. ANCE	WATTS	REPLACEMENT DATA				INSTALLATION NOTES
			PILLOT PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	
R1A	1Meg	1	36-66	C1708			Loudness, Tap @ 400K & 750K
R2A	500K	1	36-65				Volume, Tap @ 350K
R3A	1Meg	1	37-35				Volume, Tap @ 750K
R4A	5Meg	1	37-35				Treble
R5A	5Meg	1	37-35				Bass
R6A	100K	1	39-41				Photo Level, Tap @ 500K
R7A	100K	1	39-32				Photo Load

CHASSIS—TOP VIEW





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PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	PILOT PART No.	IRC PART No.		OHMS	WATT	PILOT PART No.	IRC PART No.	
R7	100K			BTS-100K	R28	100K 5%			BTS-100K 5%	
R8	6800Ω			BTS-6800	R29	82K			BTA-82K	
R9	27K 5%			BTS-27K 5%	R30	2200Ω			BTS-2200	
R10	220K 5%			BTS-220K 5%	R31	100K 5%			BTS-100K 5%	
R11	68K 5%			BTS-68K 5%	R32	220K			BTS-220K	
R12	82K 5%			BTS-82K 5%	R33	39K			BTS-39K	
R13	330K			BTS-330K	R34	2200Ω			BTS-2200	
R14	8200Ω 5%			BTS-8200 5%	R35	1Meg			BTS-1Meg	
R15	100K 5%			BTS-100K 5%	R36	100K 5%			BTS-100K 5%	
R16	82K 5%			BTS-82K 5%	R37	1500Ω			BTS-1500	
R17	2.2Meg			BTS-2.2Meg	R38	270K			BTS-270K	
R18	68K			BTA-68K	R39	100K			BTS-100K	
R19	2.2Meg			BTS-2.2Meg	R40	270K 5%			BTS-270K 5%	Note 1
R20	82K			BTA-82K	R41	12K			BTS-12K 5%	
R21	3300Ω			BTS-3300	R42	6800Ω			BTS-6800	
R22	82K			BTA-82K	R43	15K			BTS-15K	
R23	2200Ω			BTS-2200	R44	27K			BTA-27K	
R24	220K			BTS-220K	R45	22K			BTS-22K	
R25	220K 5%			BTS-220K 5%	R46	100Ω			BTS-100	
R26	150K			BTS-150K	R47	270Ω			BTS-270	
R27	4700Ω 5%			BTS-4700 5%	R48	270Ω			BTS-270	
					R49	47K			BTS-47K	

Note 1. Not used in some versions.

TRANSFORMER (POWER)

ITEM No.	RATING			PILOT PART No.	REPLACEMENT DATA		
	PRI.	SEC. 1	SEC. 2	SEC. 3	Healdorson PART No.	Merit PART No.	Stancor PART No.
T1	117VAC ② .72A	540VCT ② .106A	6.3VCT ② 2.5A	32VCT ② 320A	55-58		

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA				NOTES
	PRI.	SEC.	PILOT PART No.	Healdorson PART No.	Merit PART No.	Stancor PART No.	
T2	7300Ω 160 CT	56-51 Tap② 80.4Ω	56-51	Z1405 ①		22866 ① S-24A ①	① Fabricate mounting

PARTS LIST AND DESCRIPTIONS (Continued)

COMPONENT COMBINATIONS

ITEM No.	USE	DESCRIPTION	PILOT PART No.	REPLACEMENT DATA
K1	Tone Compensation	150MMMF, 50MMMF, 2500MMMF, 2500MMMF, 100K, 100K		Centralab PC-325

SELENIUM RECTIFIER

ITEM No.	RATING CURRENT (Measured)	REPLACEMENT DATA			NOTES
		PILOT PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	
M1	.320A	110-519	1017	C1B	604B

MISCELLANEOUS

ITEM No.	PART NAME	PILOT PART No.	NOTES
M2	Pilot Light	68-10	#1847
M3	Switch	101-41	Rumble Filter (Slide Type SPST)
M4	Switch	101-41	Scratch Filter (Slide Type SPST)
M5	Switch	100-115	Selector (Rotary Wafer Type)



H. H. SCOTT
MODEL 223

TRADE NAME	H. H. Scott Model 223	
MANUFACTURER	Hermon Hosmer Scott, Inc., 385 Putnam Ave., Cambridge 39, Mass.	
TYPE SET	AC Operated Audio Amplifier	
TUBES (Four)	Types 12AX7 AF Amp. -Phase Inv., (2) 6L6GB Output, 5U4GA Rectifier	
POWER SUPPLY	110-120 Volts AC-60 Cycles.	RATING .97 Amp. @ 117 Volts AC

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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G734

PARTS LIST AND DESCRIPTIONS TUBES (GENERAL ELECTRIC, PENNSYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	AF Amp.-Phase Inv.	12AX7	
V2	Output	6L6GB	
V3	Output	6L6GB	
V4	Rectifier	5U4GA	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA				
	CAP.	VOLT.	H. H. Scott PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.
C1A	20	475		AFH4-19-20	BO500	FP475	TMQ-123
C1B	20	475			BO500		
C1C	20	475					
C1D	20	475					
C2	50	100		FRS50V50	BR5015	TC49	TD-50-150
							FM-1550
							TVA-1414

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA					NOTES
	CAP.	VOLT.	H. H. Scott PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	
C3	.0068	400		BPD-0068	D6-682	CUB6D68	GEM-6288	6TM-D68
C4	.0027	400		BPD-0025	D6-272	G042	UC-531	5GA-T1
C5	.001	400		BPD-0001	DD-101	K085	ED-100	6HK-52
C6	20000	400		BPD-02	DD-203	K085	ED-02	4TM-947
C7	.047	400		BPD-05	DF-503	CUB4947	GEM-4147	5GA-T33
C8	330	400		BPD-00033	DD-331	G056	UC-5333	4TM-947
C9	.047	400		BPD-05	DD-503	CUB4947	GEM-4147	

CONTROLS

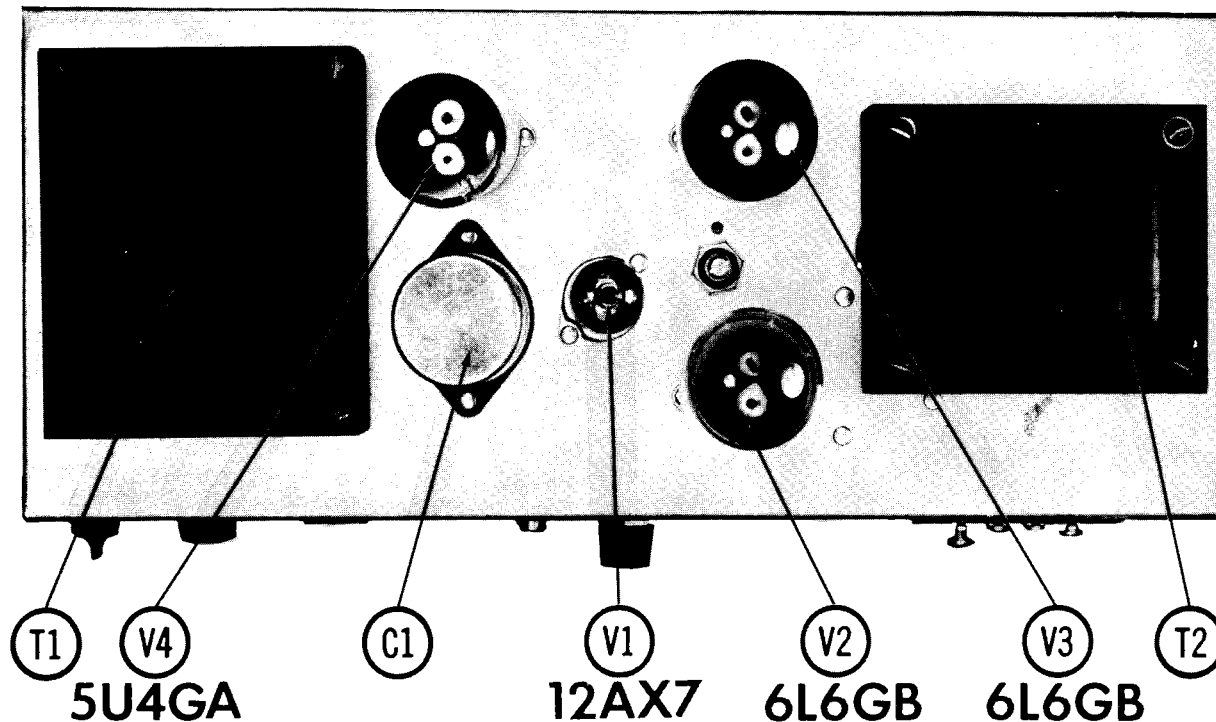
ITEM No.	RATING		REPLACEMENT DATA				INSTALLATION NOTES
	RESISTANCE	WATTS	H. H. Scott PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	
R1A	500K	1/2		B-60	A47-500K-Z	Q13-133	Level
R2A	50K	1/2		AB-31	RS-2	Not Req.	Balance
R3A	50K	1/2		AK-1	A47-50K-S	Q1-123	
					FKS-1/4	Not Req.	

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	H. H. Scott PART No.	IRC PART No.	
R3	2.2Meg			BTS-2.2Meg	
R4	100K	1		BT-100K	
R5	220K			BTS-220K	
R6	1800Ω			BTS-1800	
R7	12K			BTS-12K	
R8	2.2Meg			BTS-2.2Meg	
R9	100K			BT-100K	
R10	270K			BTS-270K	
R11	1500Ω			BTS-1500	
R12	12K			BTS-12K	
R13	330K			BTS-330K	

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA			
	PRI.	SEC. 1	SEC. 2	SEC. 3	H. H. Scott PART No.	Meritt PART No.	Stancor PART No.	Thordarson PART No.
T1	117VAC @ .97A	700VCT @ .130A	5VAC @ 3A	8.3VCT @ 2.1A	TR-10-3	P9315	PM6411 ①	22R07

① Fabricate mounting.

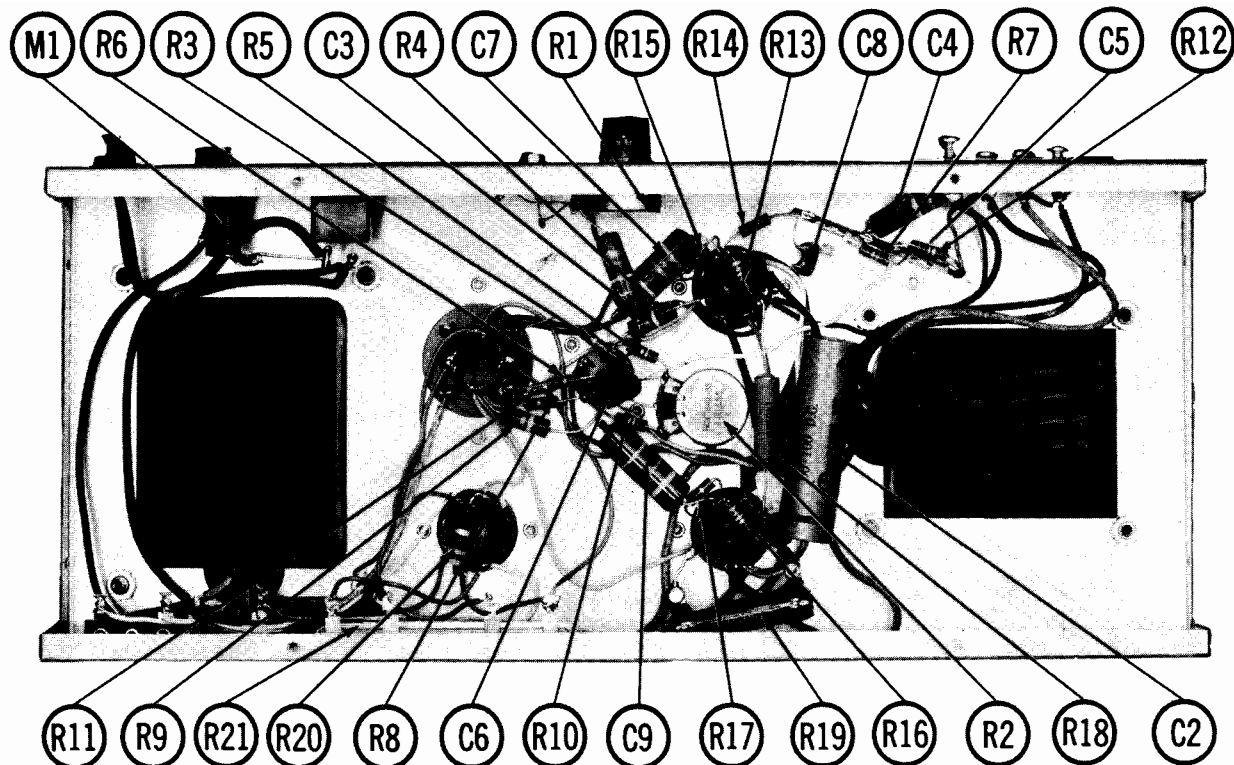
TRANSFORMER (AUDIO OUTPUT)

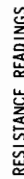
ITEM No.	IMPEDANCE		REPLACEMENT DATA				NOTES
	PRI.	SEC.	H. H. Scott PART No.	Meritt PART No.	Stancor PART No.	Thordarson PART No.	
T2	7300Ω CT	180 tap ② 80, 40	TRA-10-14				

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA			
			H. H. Scott FUSE	H. H. Scott HOLDER	LITTELFUSE FUSE	LITTELFUSE HOLDER
M1	3AG	2A	313002 (3AG S/B 2A)	342003	MDL2	HKP

CHASSIS—BOTTOM VIEW





ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7	† 85K	2.2Meg	180Ω	16Ω	16Ω	† 85K	2.2Meg	150Ω	16Ω
V2	6L6GB	TP	16Ω	† 375Ω	† 500Ω	330K	TP	16Ω	16Ω	
V3	6L6GB	TP	16Ω	† 365Ω	† 500Ω	330K	TP	16Ω	16Ω	
V4	5U4CA	NC	30K	TP	4Ω	NC	36Ω	TP	30K	

†	MEASURED FROM PIN 8 OF V4
---	---------------------------

NC NO CONNECTION.

NO CONNECT
TIF POINT

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1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of $\pm 1\%$ in voltage and resistance readings.
6. All controls at minimum, proper output load connected.



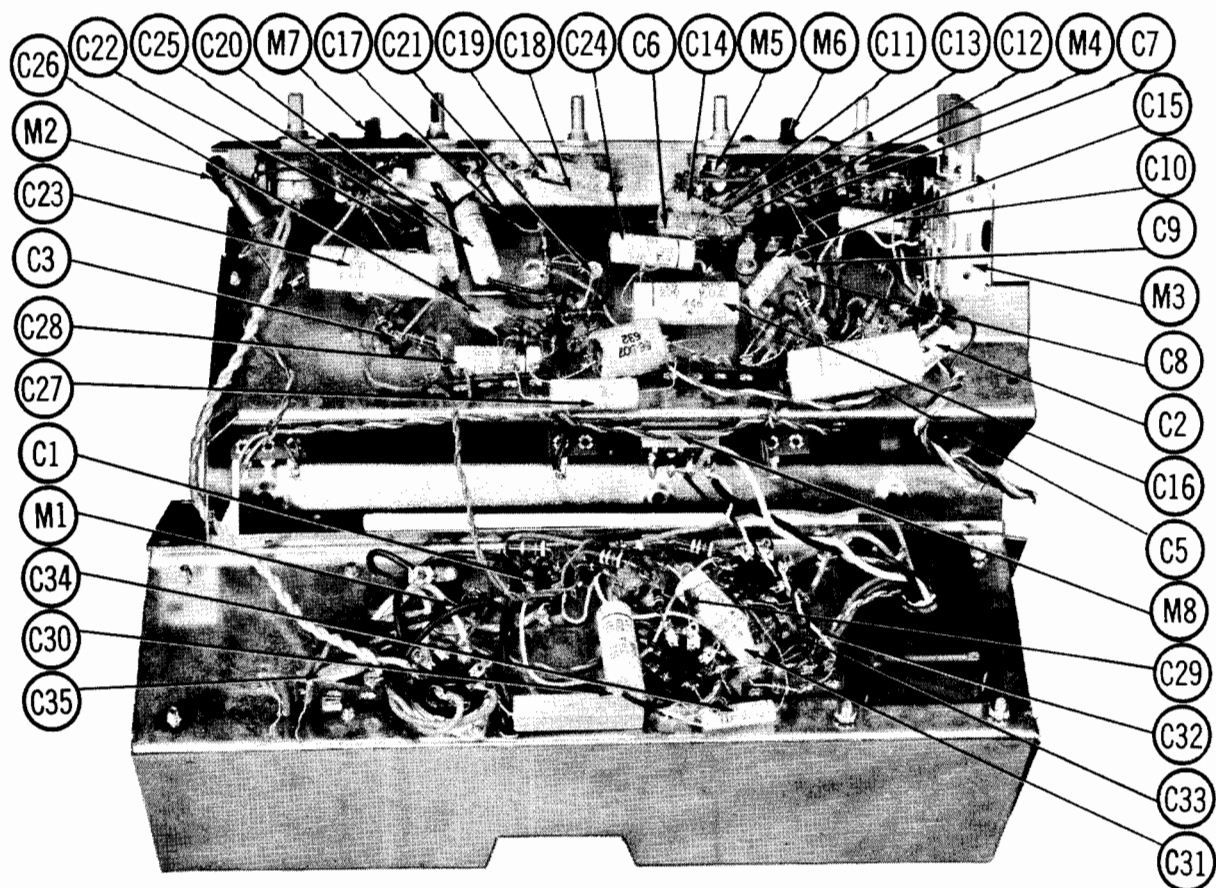
SHERWOOD
MODEL S-1000-II

TRADE NAME	Sherwood Model S-1000-II		
MANUFACTURER	Sherwood Electronic Laboratories, Inc., 2802 W. Cullom Ave., Chicago 18, Illinois		
TYPE SET	AC Operated 20 Watt Audio Amplifier		
TUBES (Seven)	Types EF86/6267 (or) Z729 Preamplifier, 12AX7/ECC83 Preamp. - Cath. Follower, 12AX7/ECC83 AF Amplifier, 6BA8A AF Amp. - Phase Inv., (2) 6L6GB Output, 5Y3GT Rectifier		
POWER SUPPLY	110-120 Volts AC-60 Cycles	RATING	.96 Amp. @ 117 Volts AC (100 Watts)

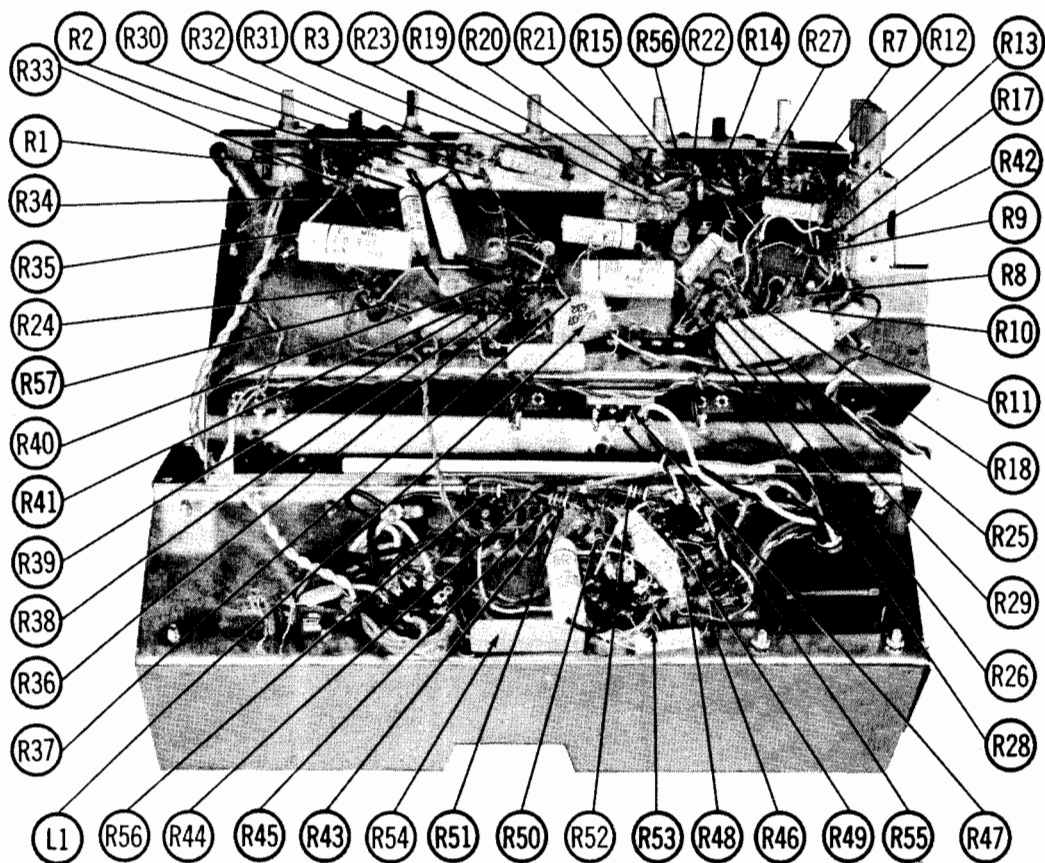
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CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

PARTS LIST AND DESCRIPTIONS TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	ITEM No.	USE	TYPE
V1	Preamplifier	EF86/6267 Note 1	V5	Output	6L6GB
V2	Preamp - Cath. Follower	12AX7/ECC83	V6	Output	6L6GB
V3	A.F. Amplifier	12AX7/ECC83	V7	Rectifier	5Y3GT
V4	A.F. Amp. - Phase Inv.	6BA8A			

Note 1. Alternate Type 2729

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA					
	CAP.	VOLT.	SHERWOOD PART No.	AEROVOX PART No.	CORNELL DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.
C1A	.40	400		AFH4-85-25	D0855	FP431-3		Q-380
C1B	.40	400						
C1C	.45	350						
C1D	.50	50						
C2A	.10	400		SRE4V50	BBR50-8	TTX560	TD-50-8	MMT-650
C2B	.15	400		AFH2-47	E0370	FP231	TMD-41	D-200

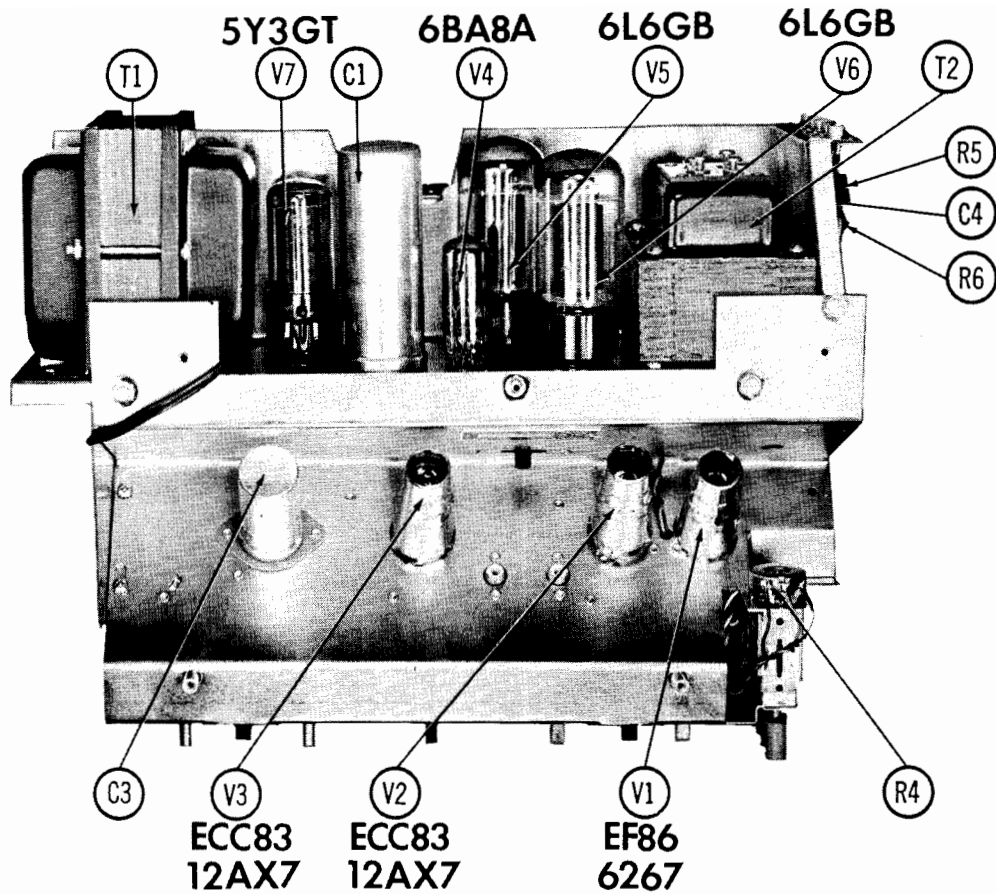
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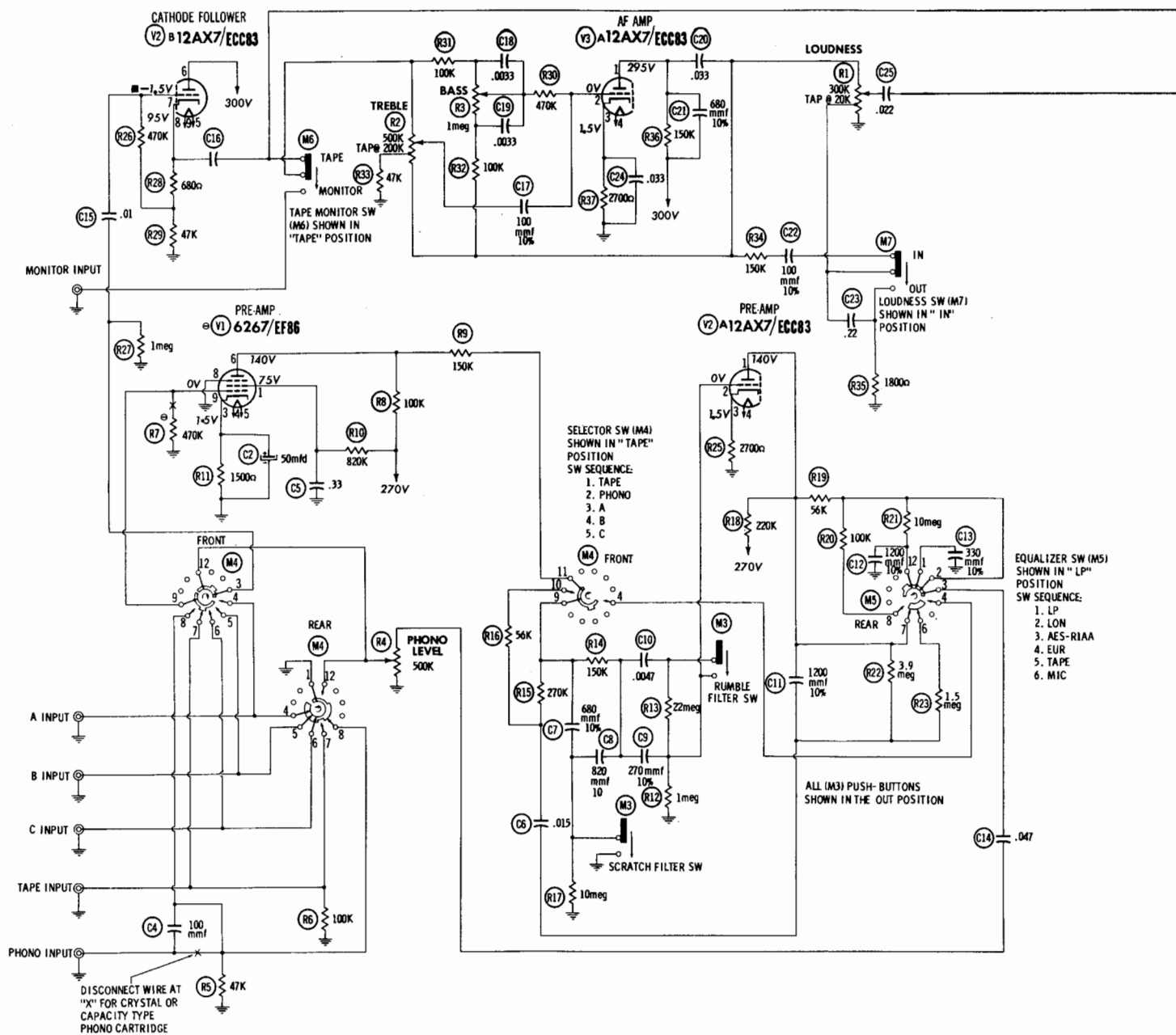
FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

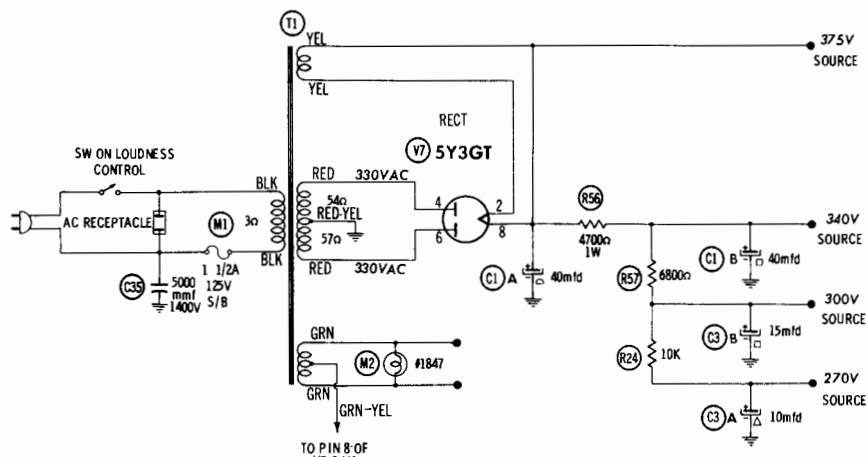
ITEM No.	RATING		SHERWOOD PART No.		AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	REPLACEMENT DATA				NOTES
	CAP.	VOLT.						ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.		
C4	100				1468-0001	D6-101	5W571	ED-100	MC235	1FM-31		
C5	.33	200			P288N-33	DD16-153	CUB6815	ED-016	GEM-2033	4TM-S15		10%
C6	.015	400			P488N-015	D6-681	IR5T68	ED-680	GEM-4115	MS-368		10%
C7	680					D6-681	IR5T82	ED-820		MS-382		10%
C8	820					D6-271	5R5T57	ED-270		MS-327		10%
C9	270				P488N-0047	D6-472	CUB6D47	GP-4700	GEM-6247	6TM-D47		10%
C10	.0047					D6-472	IR5D12	ED-1200		MS-212		10%
C11	1200						IR5D12	ED-1200		MS-212		10%
C12	1200						IR5D12	ED-1200		MS-212		10%
C13	330				P488N-047	D6-331	5R5T33	ED-330	GEM-4147	MS-333		10%
C14	.047				P488N-01	DF-503	CUB4S47		GEM-411	4TM-S47		10%
C15	.01	400			P288N-15	D6-103	CUB4S1	GP-10000	GEM-2015	2TM-P15		10%
C16	.15	200			P288N-15	D6-103	CUB2P15	GP-10000	GEM-2015	2TM-P15		10%
C17	100				1468-0001	D6-101	22R5T11	CY10C101K	MCB235	MS-31		10%
C18	.0033				P488N-0033	D6-332	CUB4D33	GP-3300	GEM-6233	6TM-D33		10%
C19	.0033				P488N-0033	D6-332	CUB4D33	GP-3300	GEM-6233	6TM-D33		10%
C20	.0033				P488N-0033	DF-303	CUB4S33	GP-3300	GEM-4133	6TM-S33		10%
C21	680				1468-0001	D6-681	IR5T68	ED-680	MCB235	MS-368		10%
C22	100				P288N-22	D6-101	22R5T11	CY10C101K	GEM-2022	MS-31		10%
C23	.22	200			P488N-22	DF-303	CUB2P22		GEM-4133	2TM-P22		10%
C24	.033	400			P488N-033	DF-303	CUB6S33		GEM-4133	6TM-S33		10%
C25	.022	400			P488N-022	DD-203	CUB4S22	ED-02	GEM-4122	4TM-S22		10%
C26	2200					DD-203	IR5D22		GEM-4122	MS-222		10%
C27	.027				P488N-025	DF-303	CUB6S33		GEM-413	4TM-S33		10%
C28	.033				P488N-033	DF-303	CUB6S33		GEM-4133	6TM-S33		10%
C29	.47				1468-000047	D6-470	22R5Q47	CY10C470K	ZT-5447	MS-447		10%
C30	.1	400			P488N-1	DF-104	CUB4P1		GEM-401	4TM-P1		10%
C31	.1	400			P488N-1	DF-104	CUB4P1		GEM-401	4TM-P1		10%
C32	.47				1468-000047	D6-470	22R5Q47	CY10C470K	ZT-5447	MS-447		10%
C33	120				1468-000012	D6-121	22R5T12	ED-120	GEM-411	4TM-S1		10%
C34	.01	400			P488N-01	D6-103	CUB4S1	GP-10000	GEM-411	MS-312		10%
C35	5000	1400			DAC-9	DD30-502	EYE16D5	HD16-4700	GEM-1625	BL-D50		10%

CHASSIS—TOP VIEW





A PHOTOFAC STANDARD NOTATION SCHEMATIC
 Howard W. Sams & Co., Inc. 1958



ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	EF86 / 6267	†840K	0Ω	1500Ω	240Ω	240Ω	†120K	0Ω	0Ω	85K
V2	12AX7 / ECC83	†240K	1meg	2700Ω	240Ω	240Ω	†11K	520K	47K	240Ω
V3	12AX7 / ECC83	†160K	670K	2700Ω	240Ω	240Ω	†93K	1meg	9500Ω	240Ω
V4	6BA6A	47K	†160K	†52K	240Ω	240Ω	680K	1meg	†2.2meg	†160K
V5	6L6GB	0Ω	240Ω	†130Ω	†25Ω	220K	240Ω	240Ω	240Ω	
V6	6L6GB	0Ω	240Ω	†122Ω	†22Ω	220K	0Ω	240Ω	240Ω	
V7	5Y3GT	NC	20K(Min)	NC	54Ω	NC	57Ω	TP	20K(Min)	

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of $\pm 15\%$ in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

TAPE OUTPUT

PARTS LIST AND DESCRIPTIONS (Continued)

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA			INSTALLATION NOTES
	RESIST-ANCE	WATTS	SHERWOOD PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	
R1A	300K	1	67LAB3			
R2A	500K	1	67OAB1	B7-65	A47F5-500K	Loudness, Tap @ 20K
R3A	500K	1	67OAB2	B7-65	UT-431	Treble, Tap @ 200K
R4	500K	1	67OAB7	B7-65	UT-431	Bass
				B7-65	UT-431	Phono Level
				B7-65	UT-431	

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		SHERWOOD PART No.	NOTES	SHERWOOD PART No.	NOTES
	OHMS	WATT				
R5	47K			Note 1		
R6	100K					
R7	470K					
R8	100K					
R9	150K					
R10	820K					
R11	1500Ω					
R12	1meg					
R13	22meg					
R14	150K					
R15	270K					
R16	56K					
R17	10meg					
R18	220K					
R19	56K					
R20	100K					
R21	10meg					
R22	3.9meg					
R23	1.5meg					
R24	10K					
R25	2700Ω					
R26	470K					
R27	1meg					
R28	800Ω					
R29	47K					
R30	470K					

Note 1. Not used in some versions.

Note 2. Some versions may use 2.2meg.

TRANSFORMER (POWER)

ITEM No.	RATING			REPLACEMENT DATA		
	PRI.	SEC. 1	SEC. 2	SHERWOOD PART No.	Merit PART No.	Thordeson PART No.
T1	117V	700VCT	5V	922AB1		
	⑤ .96A	⑤ .125A	⑤ 2A			

PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA					NOTES
	PRI.	SEC.	SHERWOOD PART No.	Halldorson PART No.	Merit PART No.	Shoncor PART No.	Triad PART No.	
T2	5500Ω	160 CT	920AB1					
	⑤ 80, 412							

COILS

ITEM No.	USE	REPLACEMENT DATA				NOTES
		SHERWOOD PART No.	MEISSNER PART No.	Merit PART No.	MILLER PART No.	
L1	Tone Choke					140 Millihenries

FUSES

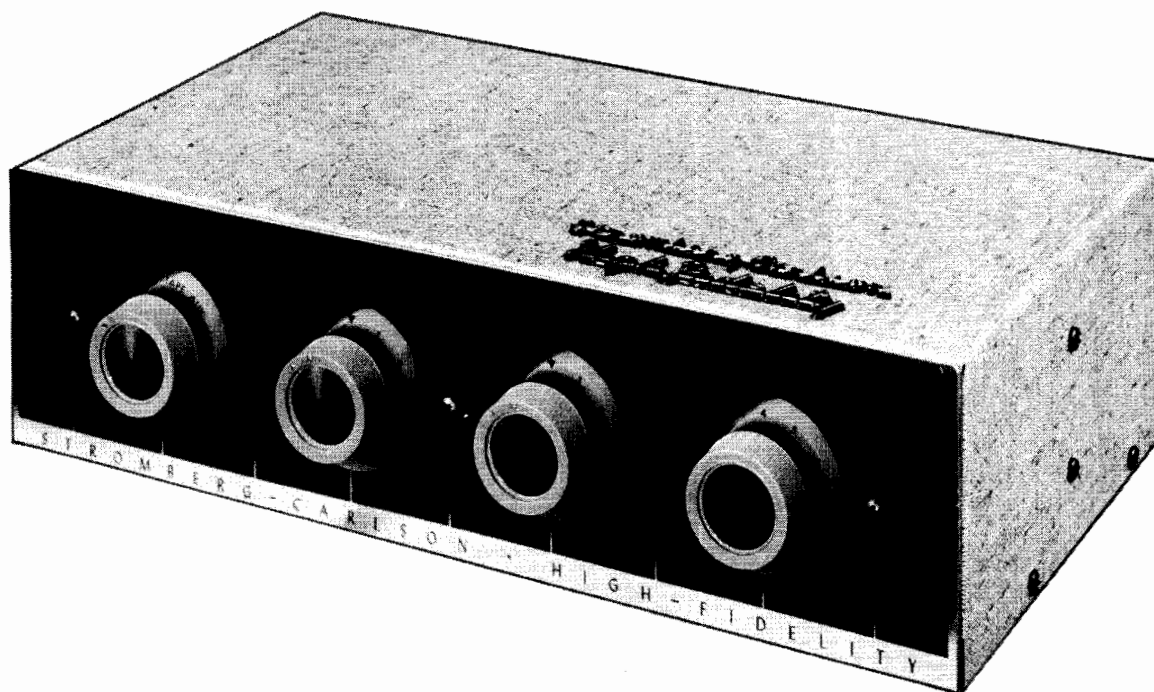
ITEM No.	TYPE	RATING	REPLACEMENT DATA			
			SHERWOOD PART No.	FUSE	HOLDER	BUSS PART No.
M1	3AG	1 1/4 A 125V S/B		31301.5 (3AG 1 1/4 125V S/B)	342003	MDL1 1/4 HXP

MISCELLANEOUS

ITEM No.	PART NAME	SHERWOOD PART No.	NOTES	
M2	Pilot Lamp		#1847	
M3	Switch Assy		Presence, Scratch Filter, Rumble Filter, Phono Level	
M4	Switch		Selector (Rotary Water Type)	
M5	Switch		Equalization (Rotary Water Type)	
M6	Switch		Tape Monitor (Slide Type SPD7)	
M7	Switch		Loudness (Slide Type SPD7)	
M8	Switch		Damping Factor (Slide Type DPD7)	

WIRING DATA

General-use Unshielded Hook-up Wire		Use BELDEN No. 8530 (Solid) Available in Ten Colors
Power Cord		8524 (Stranded) Available in Ten Colors
Low-Loss Shielded Lead (Interconnecting)		Use BELDEN No. 1765-B (6 Ft. Length)
Phono Pick-up Arm Cable		1725-K (7 1/2 Ft. Length)
		Use BELDEN No. 8430 (Two Conductor - Twisted)



STROMBERG-CARLSON
MODEL AR-411

TRADE NAME	Stromberg-Carlson Model AR-411		
MANUFACTURER	Stromberg-Carlson Co., Service Dept., 1700 University Ave., Rochester 10, N. Y.		
TYPE SET	AC Operated 4 Channel Audio Amplifier		
TUBES (Six)	Types 12AT7 Phono Preamplifier, 12AX7 AF Amplifier, 6AV6 Phase Inverter, (2) 6CM6 Output, 5Y3GT Rectifier		
POWER SUPPLY	105-125 Volts AC-50/60 Cycles	RATING	.68 Amp. @ 117 Volts AC (68 Watts)

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of

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PARTS LIST AND DESCRIPTIONS TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Phono Preamplifier	12AT7	
V2	AF Amplifier	12AX7	
V3	Phase Inverter	6AV6	
V4	Output	6CM6	
V5	Output	6CM6	
V6	Rectifier	5Y3GT	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA					
	CAP.	VOLT.	Stromberg-Carlson PART No.	AEROVOX PART No.	CORNEILL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SPRAGUE PART No.
C1A	40	450	35590			FP447		Q-080
C1B	30	350				TC47		MT-0550
C1C	15	300						
C1D	50	50						
C2A	20	450	111619	AFH2-69	B0500	FP234	TMD-61	D-225
C2B	20	450						
C3	50	6	111815-000	PRS25V50	BBR50-6	TC29	TD-50-6	MMT-650

FIXED CAPACITORS

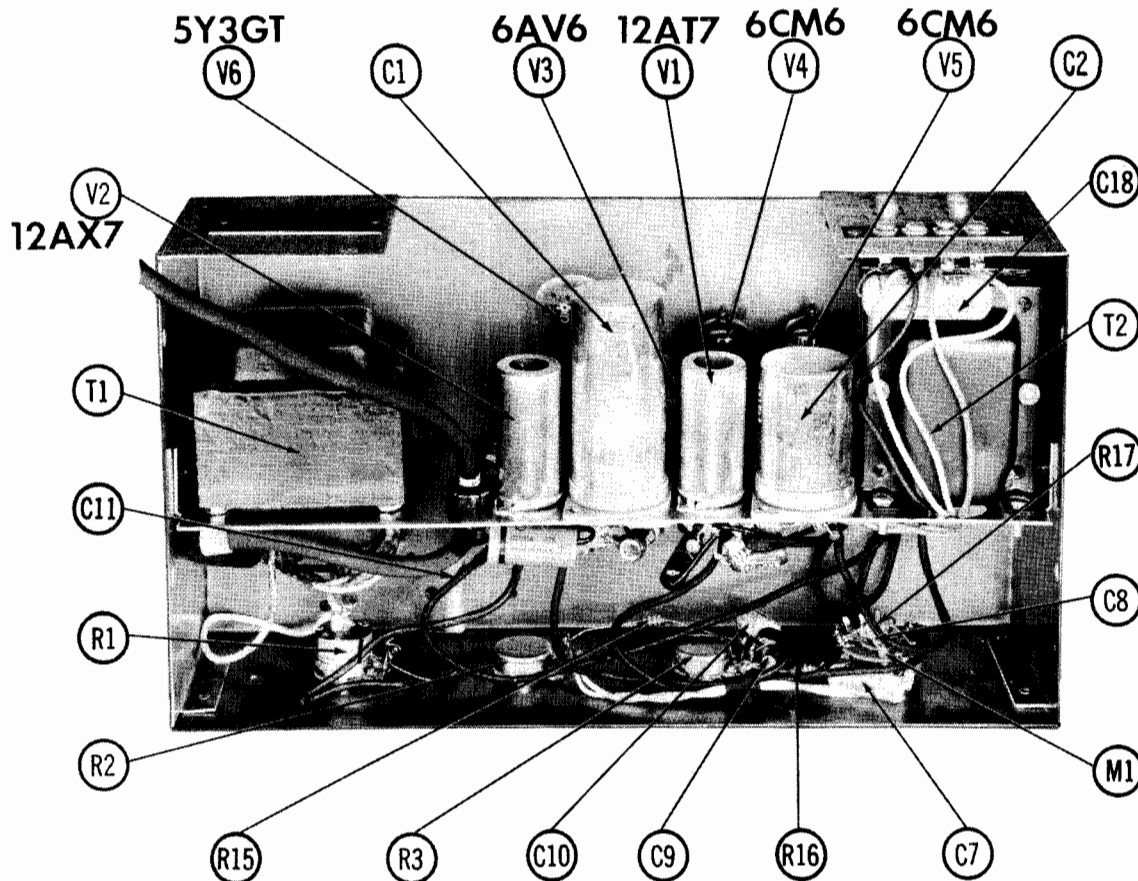
Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA					
	CAP.	VOLT.	Stromberg-Carlson PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNEILL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.
C4	.01	600		P488N-01	D6-103	CUB6S1	GP-10000	GEM-611
C5	470			SI 220	D6-471	LT6147	GP-170	UC-5247
C6	220	400		P488N-022	D6-221	LT6122	GP-220	UC-5222
C7	.022	400		SI 470	D6-203	CUB4S22	ED-02	GEM-4122
C8	470			SI 470	D6-471	LT6147	GP-470	UC-5347
C9	470			P488N-0047	D6-472	CUB6D47	GP-4700	GEM-0247
C10	.0047	600		P488N-022	D6-472	CUB4S22	ED-02	GEM-4122
C11	.022	400		SI 27	D6-270	LT6Q27	GP-27	UC-5427
C12	.047	400		P488N-047	DF-503	CUB4S47	GP-220	GEM-4147
C13	.047	400		SI 220	D6-321	LT6122		UC-5322
C14	.220	400		P488N-047	DF-503	CUB4S47		GEM-4147
C15	.047	400		P488N-047	DF-503	CUB4S47		GEM-4147
C16	.047	400		P488N-047	DF-503	CUB4S47		GEM-4147
C17	.22	400		P488N-22	DF-503	CUB4P22		GEM-1022

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESIST. ANCE	WATTS	Stromberg-Carlson PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	500K	1/2	145638	B-60-S	A47-500K-S	Q13-133	U48	Volume
R1B	Shaft			Not Req.	FS-3	76-1	Not Req.	
R2A	1Meg	1	145639	B-69	SWE-12	Q11-137	US-26	Treble
R2B	5Meg	1		Not Req.	A47-1Meg-S	Q11-141	Not Req.	
R3A	5Meg	1	145630	B-87	FS-3	Q13-141	U65	Bass
R3B	Shaft			Not Req.	A47-5Meg-2	Q13-141	Not Req.	
R4A	100K	2	145632	WN-101	FS-3	W11-094	RI00L	Hum Adj. (Wire Wound)
R4B	Shaft			Not Req.	A43-100	W11-094	Not Req.	
					FKS-1/4	SK5-K1t	Not Req.	

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		NOTES	Stromberg-Carlson PART No.	ITEM No.	RATING		NOTES	Stromberg-Carlson PART No.
	OHMS	WATT				OHMS	WATT		
R5	1Meg				R20	470K			
R6	1Meg				R21	6800Ω			
R7	1Meg				R22	56K			
R8	47K				R23	680K			
R9	220K				R24	3.3Meg			
R10	5600Ω				R25	22K			
R11	390K				R26	47K			
R12	470K				R27	47K			
R13	220K				R28	100K			
R14	5600Ω				R29	100K			
R15	47K				R30	250Ω	5		
R16	100K				R31	2000Ω	5		
R17	470K				R32	22K			
R18	220K				R33	10K			
R19	6800Ω				R34	100K			

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA			
	PRI.	SEC. 1	SEC. 2	SEC. 3	Stromberg-Carlson PART No.	Holldorson PART No.	Merit PART No.	Triad PART No.
T1	117VAC	620VCT	5VAC	6.3VAC	161798 ①			
	③ .88A	③ .170A	③ 2A	③ 1.8A				

① Used in series 105A and later. Part #161780 used in series 105 and earlier.

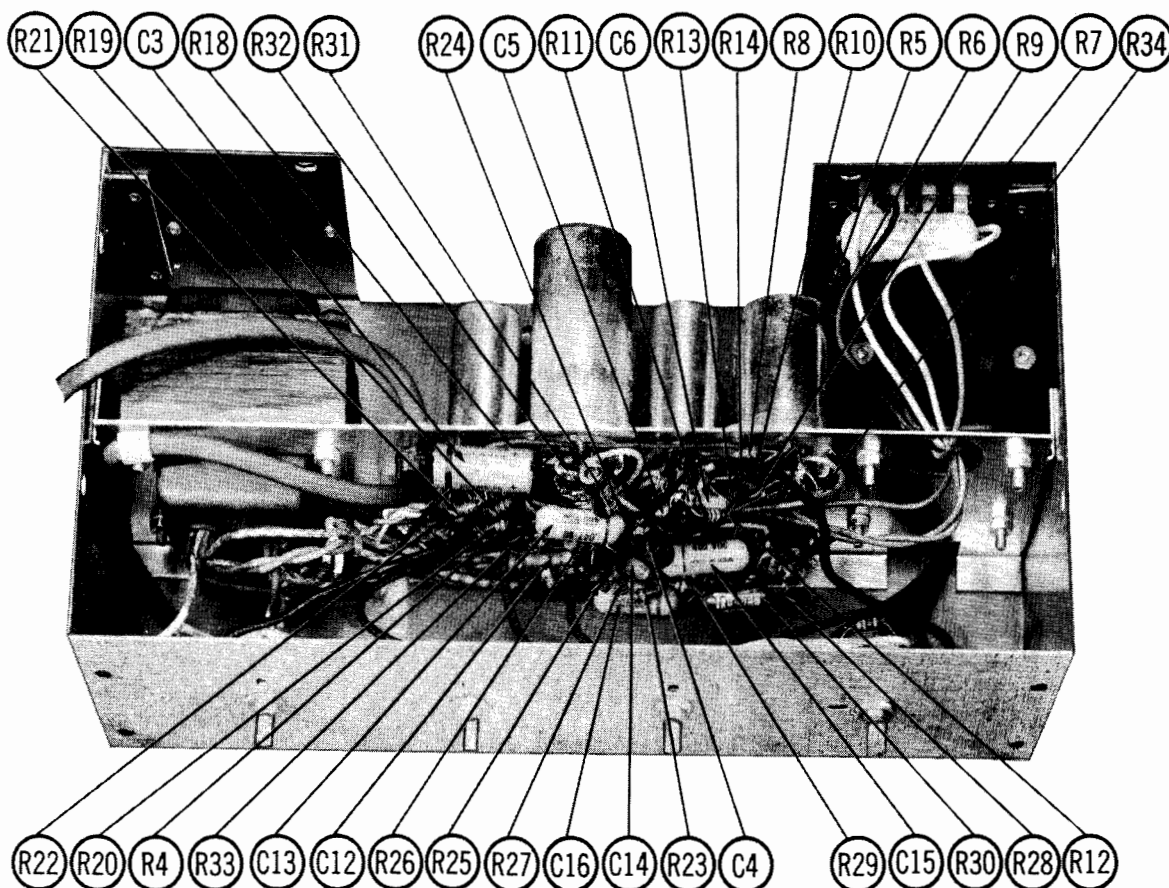
TRANSFORMER (AUDIO OUTPUT)

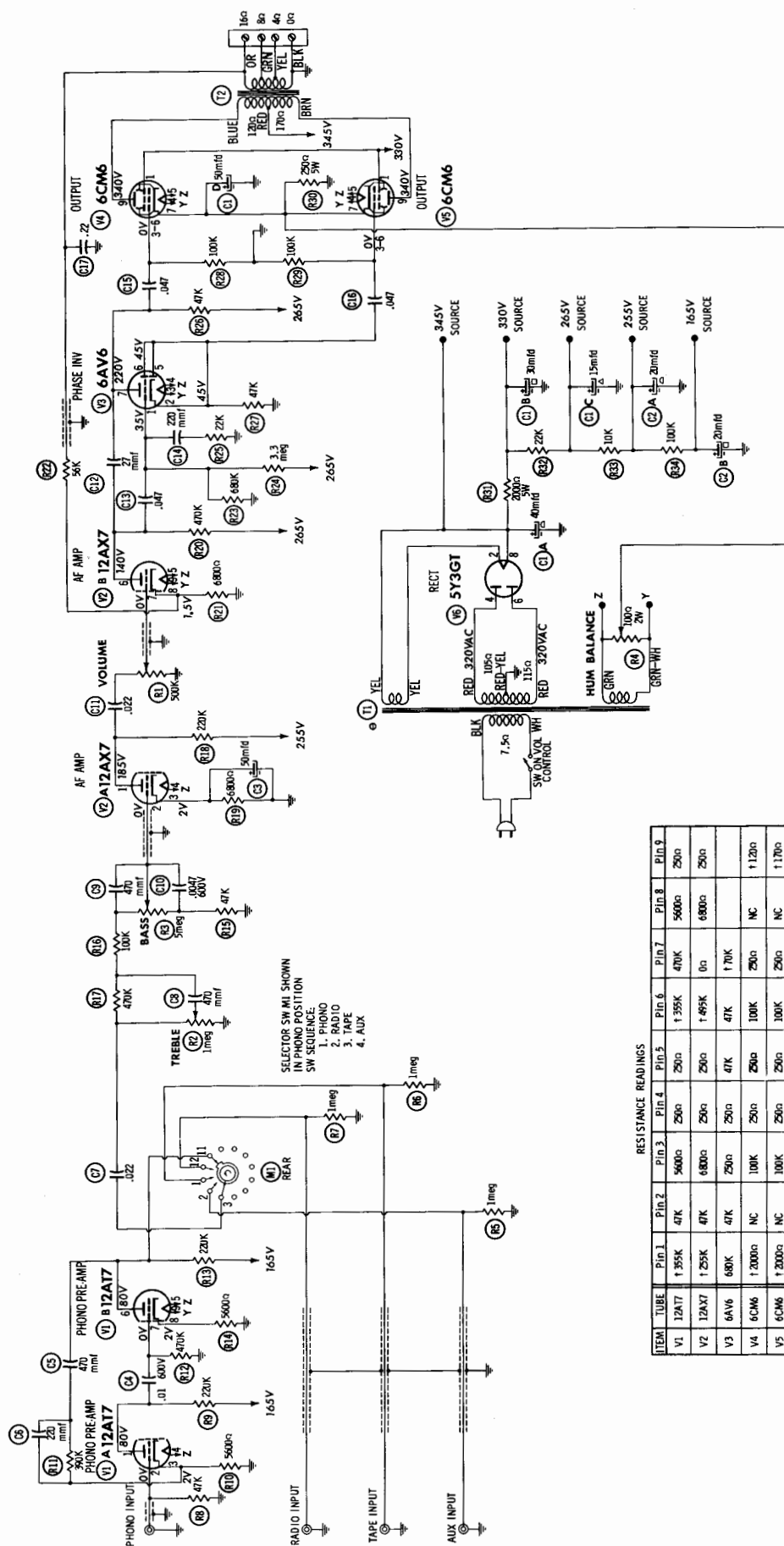
ITEM No.	IMPEDANCE		REPLACEMENT DATA				NOTES
	PRI.	SEC.	Stromberg-Carlson PART No.	Holldorson PART No.	Merit PART No.	Stencor PART No.	
T2	6500Ω CT	16Ω Tap 8Ω, 4Ω	161345			A-3304	22S88

MISCELLANEOUS

ITEM No.	PART NAME	Stromberg-Carlson PART No.	NOTES
M1	Switch	158682	Selector (Rotary Wafer Type)

CHASSIS—BOTTOM VIEW





RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7	1.35K	47K	500Ω	250Ω	250Ω	1.35K	47K	500Ω	250Ω
V2	12AX7	1.25K	47K	480Ω	250Ω	250Ω	1.45K	0Ω	680Ω	250Ω
V3	6AV6	60K	47K	250Ω	250Ω	47K	47K	170K		
V4	6CM6	1.200Ω	NC	100K	250Ω	250Ω	100K	250Ω	NC	1.120Ω
V5	6CM6	1.200Ω	NC	100K	250Ω	250Ω	100K	250Ω	NC	1.170Ω
V6	5Y3GT	NC	20K(Min)	NC	105Ω	NC	115Ω	NC	20K(Min)	

ALL MEASUREMENTS TAKEN IN "PHONO" POSITION

† MEASURED FROM PIN 8 OF V6

NC NO CONNECTION

SEE PARTS LIST FOR ALTERNATE
VALUE OR APPLICATION

1. DC voltage measurements taken with vacuum tube voltmeter;

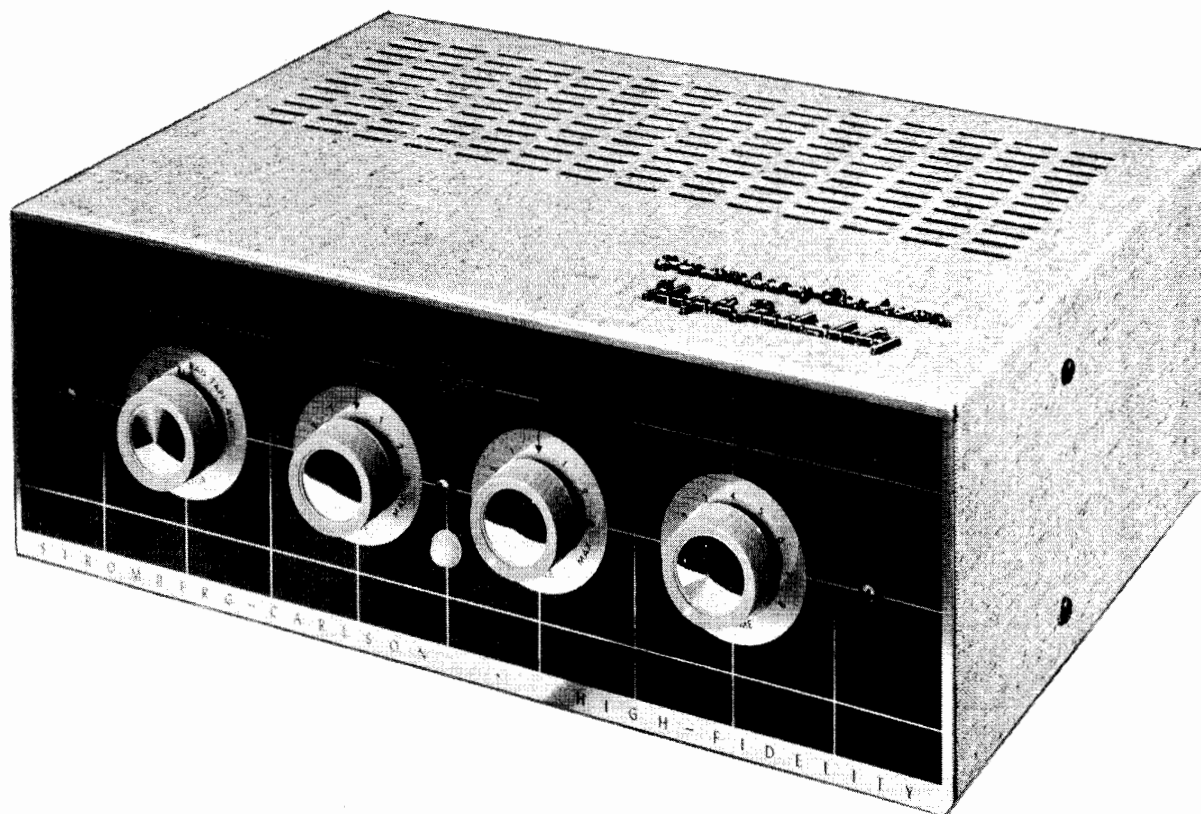
2. AC voltage measured at 1000 ohms per volt.

3. Socket connections are shown at bottom views.

4. Line voltage maintained at 117 volts for voltage readings.

5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.

6. All controls at minimum, proper output load connected.



STROMBERG-CARLSON
MODEL AR-419

TRADE NAME	Stromberg-Carlson Model AR-419		
MANUFACTURER	Stromberg-Carlson Co., Service Dept., 1700 University Ave., Rochester 10, N. Y.		
TYPE SET	AC Operated Audio Amplifier		
TUBES (Six)	Types 6SJ7 AF Amplifier, 12AT7 AF Amplifier, 12AT7 AF Amp. - Phase Inv., (2) 6L6GB Output, 5U4GB Rectifier		
POWER SUPPLY	110-120 Volts AC-60 Cycles	RATING	1.1 Amp. @ 117 Volts AC (110 Watts)

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PARTS LIST AND DESCRIPTIONS TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	AF Amplifier	6SJ7	
V2	AF Amplifier	12AT7	
V3	AF Amp. - Phase Inv.	12AT7	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING	REPLACEMENT DATA				
		Siromberg-Carlson PART No.	AEROVOX PART No.	CORNEILL DUBIER PART No.	MALLORY PART No.	SPRAGUE PART No.
C1A	500	48320-000	AFH2-72	B0530	FP284	TVL-2937
C1B	500					
C2A	450	35590-000	AFH4-85-25	D0650	FP431. 3	TVL-4705. 8
C2B	300					
C2C	350					
C2D	30					
C3	50		XP8P50	BBR50-8	TT8X50	MMT-850
	6					TVA-1100

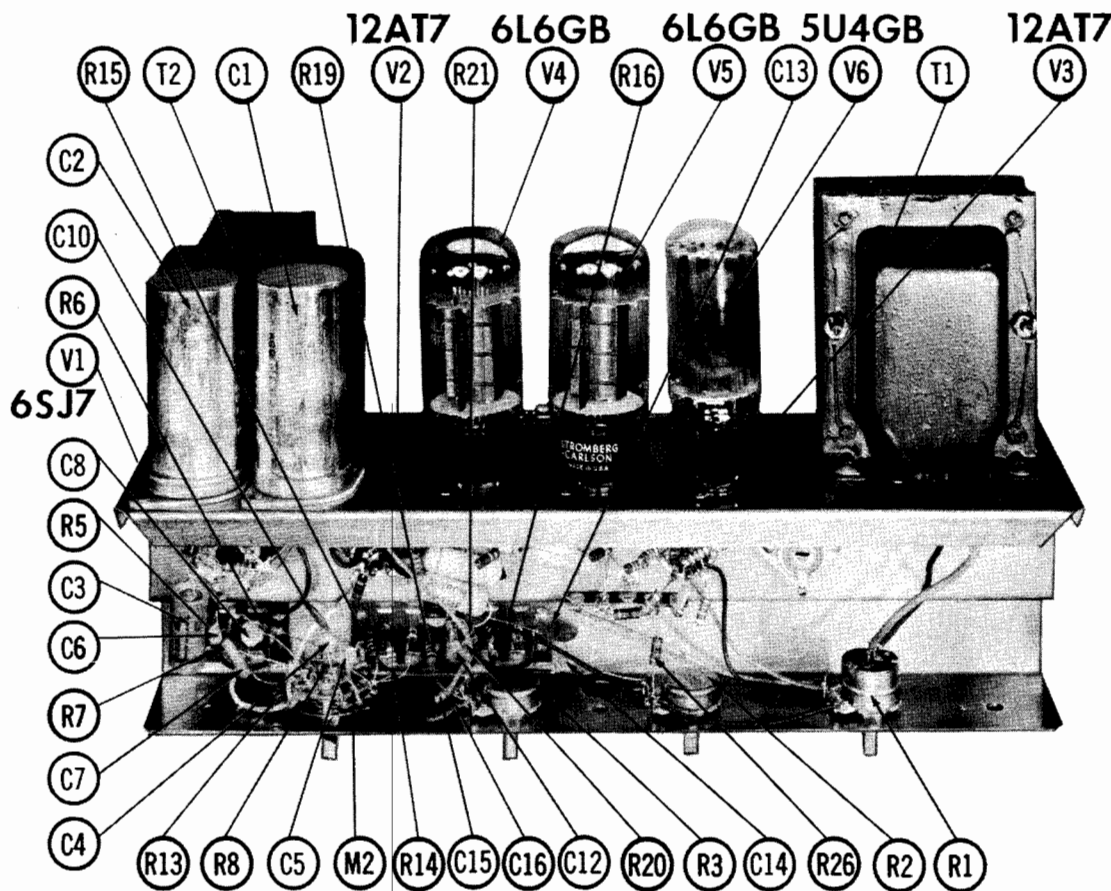
FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING	REPLACEMENT DATA					NOTES
		Siromberg-Carlson PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNEILL DUBIER PART No.	ERIE PART No.	
C4	100		BPD-0001	DD-101	L1071	ED-100	SGA-T1
C5	100		BPD-0001	DD-101	L1071	ED-100	UC-531
C6	100		BPD-0001	DD-101	L1071	ED-100	UC-531
C7	47			DD-101	L1071	ED-100	UC-531
C8	330		SI 47-00033	DD-470	L1071	GP-47	UC-5447
C9	22		P488N-22	DD-331	L1073	ED-330	UC-5333
C10	4700		BPD-0047	DD-472	CUB4P22	GEM-4022	4TM-P22
C11	33		SI 33	DD-330	BYAJ0D47	ED-0047	SGA-D47
C12	33		P488N-033	DD-330	CUB6S33	GEM-4133	6TM-S33
C13	470		BPD-0047	DD-472	BYAJ0D47	ED-0047	UC-5433
C14	470		BPD-00047	DD-471	BYAJ0T47	ED-470	UC-5247
C15	470		BPD-00047	DD-471	BYAJ0T47	ED-470	UC-5347
C16	4700		P488N-033	DD-472	BYAJ0D47	ED-0047	UC-5247
C17	0.033		BPD-00047	DD-471	CUB6S33	GEM-4133	6TM-S33
C18	470		P488N-033	DD-471	BYAJ0T47	ED-470	UC-5347
C19	.1		P488N-1	DF-104	CUB4P1	GEM-401	4TM-P1
C20	.1		P488N-1	DF-104	CUB4P1	GEM-401	4TM-P1
C21	.1		P488N-1	DF-104	CUB4P1	GEM-401	4TM-P1

CONTROLS

ITEM No.	RATING	REPLACEMENT DATA				INSTALLATION NOTES
		Siromberg-Carlson PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	
R1A	500K	145622-000	B-50-S	A47-500K-Z	Q11-133	Volume
R1B	Shaft		Not Req.	FS-3	U46	Not Req.
R1C	Switch		Not Req.	SWE-12	US-28	Treble
R2A	5Meg	145681-000	AB-88	A47-5Meg-Z	Q13-141	Not Req.
R2B	Shaft		Not Req.	FS-3	U95	Not Req.
R2C	5Meg	145681-000	AB-88	A47-5Meg-Z	Q13-141	Not Req.
R3	Shaft		Not Req.	FS-3	U95	Not Req.
R4	100K	173853-000	AK-7	FS-3	Not Req.	Hum Adjust (Wire Wound)



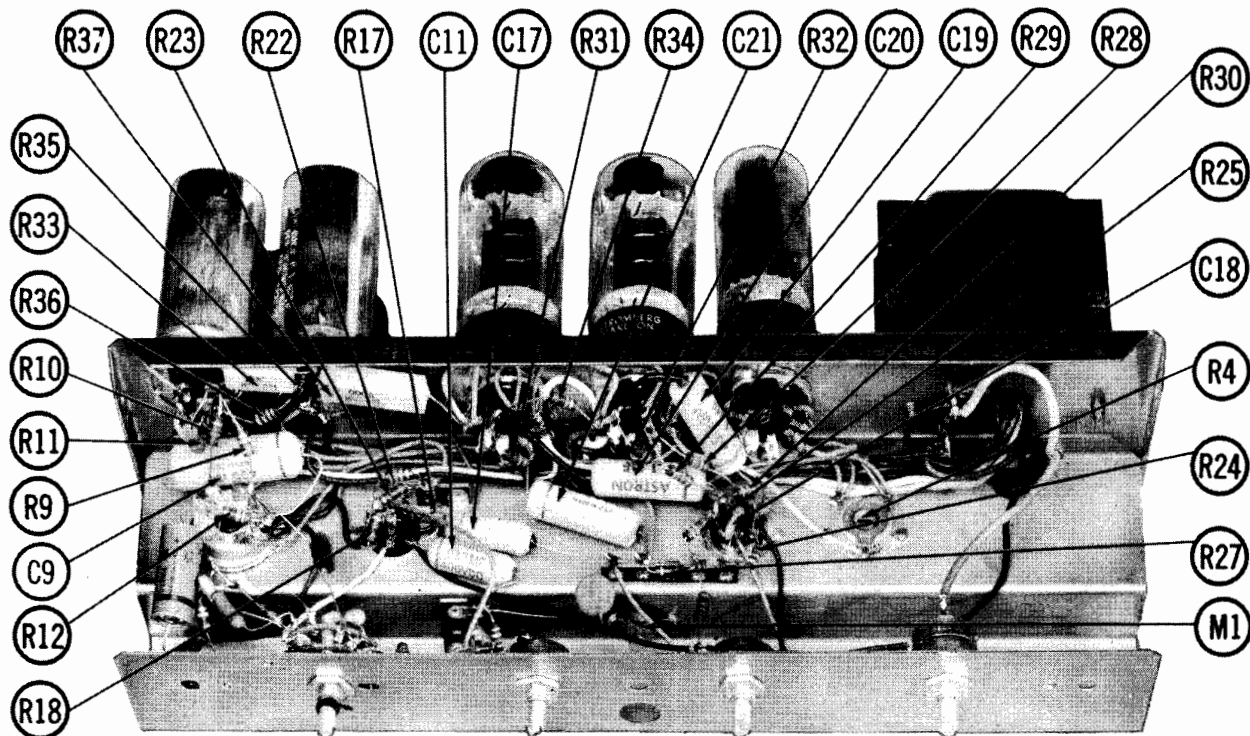
PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	Stromberg-Carlson PART No.	IRC PART No.		OHMS	WATT	Stromberg-Carlson PART No.	IRC PART No.	
R5	100K				R21	470K				
R6	1Meg				R22	47K				
R7	100K				R23	15000Ω				
R8	8.2Meg				R24	47000Ω				
R9	470K				R25	3300Ω				
R10	1.8Meg				R26	100Ω				
R11	100K				R27	1000Ω				
R12	3300Ω				R28	470K				
R13	470K				R29	47K				
R14	470K				R30	47K				
R15	33K				R31	220K				
R16	1.8Meg				R32	220K	5			
R17	33K				R33	200Ω				
R18	1000Ω				R34	15K				
R19	47K				R35	47K				
R20	470K				R36	47K				
					R37	5000Ω	7			

CHASSIS—BOTTOM VIEW



TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	Stromberg - Carlson PART No.	Holldorson PART No.	Meritt PART No.	Stancor PART No.	Thordorson PART No.	Triod PART No.
T1	117VAC ① 1.1A	720VCT ① .140A	5VAC ② 3A	8.3VAC ③ 2.8A	181795-000	P9314 ①	P-3173 ①	PC8410 ①	24R05U ①	R-14A ①

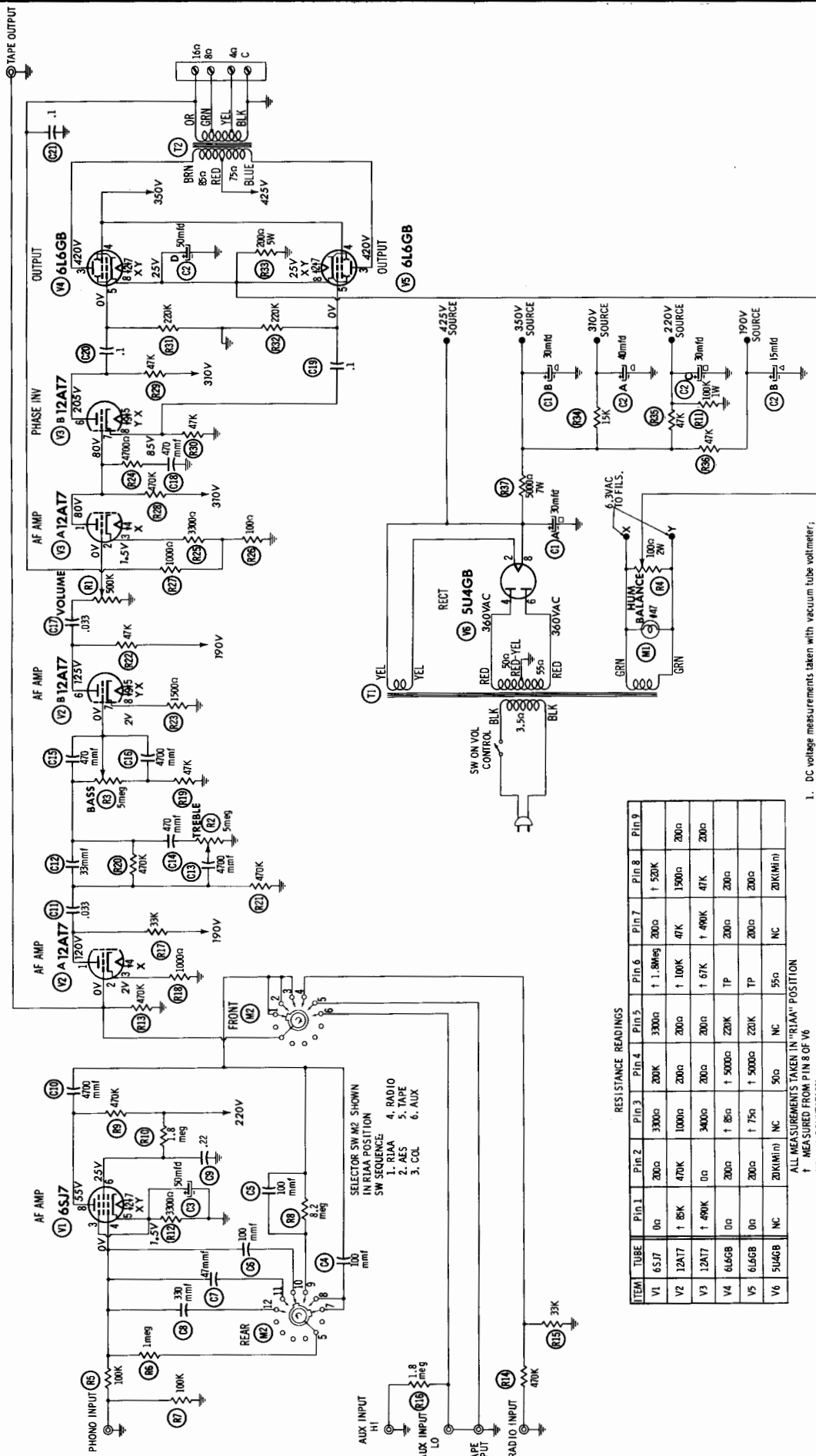
① Drill new mounting holes.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA								NOTES
	PRI.	SEC.	Stromberg-Carlson PART No.	Halldorson PART No.	Meritt PART No.	Stancor PART No.	Thordorson PART No.	Triod PART No.			
T2	5700Ω CT	16Ω Tap@ 80, 40	161355-000	21401	A-3131	A-3307	22S87 ①	S-60A ①	① Drill new mounting holes.		

MISCELLANEOUS

ITEM No.	PART NAME	Stromberg-Carlson PART No.	NOTES
M1	Pilot Lamp		
M2	Switch	156892-000	#47 Selector (Rotary Waler Type)



RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	6SJ7	0a	200a	3300a	200K	200a	1.8Meg	200a	520K	
V2	12AT7	1.8K	470K	1000a	200a	200a	1.00K	47K	1500a	200a
V3	12AT7	1.8K	470K	1000a	200a	200a	1.00K	47K	1500a	200a
V4	6L6GB	0a	200a	3300a	200K	200a	1.8Meg	200a	520K	
V5	6L6GB	0a	200a	3300a	200K	200a	1.8Meg	200a	520K	
V6	5U4GB	NC	200K(100)	NC	50a	NC	55a	NC	20K(100)	

ALL MEASUREMENTS TAKEN IN "RADIO" POSITION

† MEASURED FROM PIN 5 OF V6

NC NO CONNECTION

TP TIE POINT

1. DC voltage measurements taken with vacuum tube voltmeter;
2. AC voltage measurements at 1000 ohms per volt.
3. Socket connections are shown as bottom views.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of $\pm 15\%$ in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

2

SERVICING hi-fi PREAMPS AND AMPLIFIERS

SERVICING HI-FI PREAMPS AND AMPLIFIERS

Contains complete information on the circuitry, specifications and replacement parts for 1957-58 Preamps and Amplifiers. Data on the following brand names appears in this volume:

BELL SOUND	HARMON-KARDON
CHALLENGER	KNIGHT
DAVID BOGEN	MADISON FIELDING
ELECTRO-VOICE	NEWCOMB
FISHER	PILOT
GROMMES	SCOTT (H. H.)
HAMILTON	SHERWOOD

STROMBERG-CARLSON

A



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